CASIO

CASIO

*Scientific calculator*
*Calculadora científica*
*Calculadora científica*

# *fx-4200P*


ESPAÑOL 71
PORTUGUÊS 141



SA01021902B
Printed in Japan

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## Introduction

Congratulations on your selection of the Casio fx-4200P scientific calculator. The fx-4200P is a truly sophisticated scientific tool made possible by state-of-the-art calculator engineering. Features include:

•12-digit dot matrix display for clear display of numbers, letters and symbols
•MEMO function for storage of formulas, constants or other data
•Formula memory for simplified repeat calculations
•Standard arithmetic operations, scientific functions, and statistical calculations

All of this makes the Casio fx-4200P a powerful tool that takes much of the work out of complex calculating chores.

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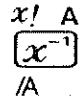
# 1/Meet the Scientific Calculator

The scientific calculator differs from the standard type in that it has many more keys and that each key has a number of different functions. In this section you will learn about how these keys and functions, as well as the general flow of basic operations for your scientific calculator. We recommend that you spend a few minutes reading through this section before continuing on to actual operation.

## 1. Reading the Key Function Indicators

As mentioned above, each key of the scientific calculator is capable of a variety of functions. For example, you would use a key such as the one illustrated below for the four functions: $x^{-1}$, $x!$, A and /A (what each of these markings means will be covered later in this manual).



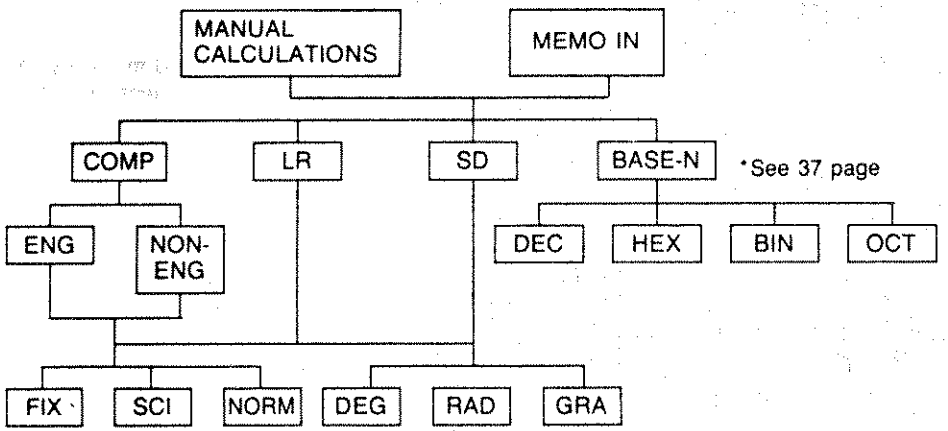

With this key, simply pressing it will perform the $x^{-1}$ function, pressing it following the [SHIFT] key performs the $x!$ function, pressing it following the [ALPHA] key enters the variable A, while hexadecimal number /A is entered when the key is pressed in the BASE-N mode (page 3). Besides these three, some keys are marked with other functions that can only be performed in the SD (standard deviation) mode or LR (regression analysis) mode (see page 4 for modes).

All of this may sound a little hard to remember. To help you keep them straight, the function markings that appear above and below the keys have been color coded. Note the following:

| Marking | Meaning |
|---|---|
| Orange | Press after [SHIFT]. |
| Red | Press after [ALPHA]. |
| Green | Press in BASE-N mode. |
| Blue | Press in SD or LR mode. |

## 2. Understanding Modes

Before you start your calculations on a scientific calculator, you much first tell it how to handle the information you are about to input. The way that the calculator handles the information you give it depends on the ***mode*** that the calculated is in.
Once you put the calculator into a mode, you may be required to make one or more further choices. The following illustration shows all of the modes possible, and their relationship with each other.




| | | | |
|---|---|---|---|
| MEMO IN | Memo input | OCT | Octal |
| COMP | Compute | FIX | Number of decimal places |
| LR | Regression analysis | SCI | Number of significant digits |
| SD | Standard deviation | NORM | Normal |
| ENG | Engineering | DEG | Degrees |
| DEC | Decimal | RAD | Radians |
| HEX | Hexadecimal | GRA | Grads |
| BIN | Binary | | |

You can change the mode of the calculator by pressing the [MODE] key followed by a number. For your convenience, we have included a table of modes and the method you should use to specify them right under the calculator's display.

*The currently selected mode specifications are retained even when you switch the calculator off.

*After resetting the calculator (see page 14), the COMP, DEG and NORM modes are in effect.

## ■ Calculation Modes

**[MODE] [0] — COMP mode**

Use this mode for general calculations, including those that employ scientific functions. You should remember that no indicator appears on the display for the COMP mode.

**[MODE] [1] — BASE-N mode**

Use the BASE-N mode for binary/octal/decimal/hexadecimal conversions and calculations, as well as for logical (Boolean) operations. The symbol BASE-N is shown on the display while the calculator is in this mode.



**[MODE] [2] — LR mode**

Use the LR mode for regression calculations. The symbol LR is shown on the display while the calculator is in this mode.

**[MODE] [3] — SD mode**

Use the SD mode for standard deviation calculations. The symbol SD is shown on the display while the calculator is in this mode.

*Only one calculation mode can be in effect at any time — they cannot be used in combination.

## ■ Engineering Mode

**[MODE] [·] — ENG mode**

Use the ENG mode in combination with the calculation modes to perform engineering symbol calculations. The symbol ENG is shown on the display while the calculator is in this mode. Repeat this operation to leave the engineering mode. See page 36 for details on the ENG mode.

## ■ Angle Modes

**[MODE] [4] — DEG mode**

Use this mode to calculate in degrees. The symbol **D** is shown on the display while the calculator is in this mode.

**[MODE] [5] — RAD mode**

Use this mode to calculate in radians. The symbol **R** is shown on the display while the calculator is in this mode.

**[MODE] [6] — GRA mode**

Use this mode to calculate in grads (100 grads = $\pi/2$rad = 90°). The symbol **G** is shown on the display while the calculator is in this mode.

*The angle modes are used in combination with calculation modes (except for BASE-N).

## ■ Display Modes

**[MODE] [7] — FIX mode**

Use the FIX mode to specify the number of decimal places for the fractional part of a value. The symbol FIX is shown on the display while the calculator is in this mode.

**[MODE] [8] — SCI mode**

Use the SCI mode to specify the number of significant digits for a value. The symbol SCI is shown on the display while the calculator is in this mode.

**[MODE] [9] — NORM mode**

Use the NORMAL mode to cancel specifications made in the FIX and SCI modes. No symbol is shown on the display while the calculator is in this mode. This operation also changes the range of the exponent display (see page 6).

*The display modes are used in combination with calculation modes (except for BASE-N).

## ■ Memo In Mode

**[MODE] [EXP] — MEMO IN mode**

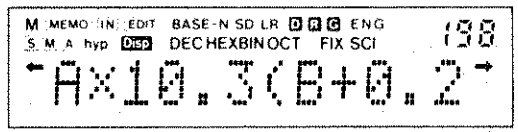
Use this mode to input or edit memos. The symbol [MEMO] [IN] is shown on the display while the calculator is in this mode. Repeat this operation to leave the MEMO IN mode. See page 59 for details on the MEMO IN mode.

*When you store data using the MEMO IN mode, the current calculation mode is also stored along with the data.

# 3. Reading the Display

## ■ Symbols and Indicators

When you look at the display of the calculator, you can see various symbols and indicators. These tell you the status and mode of the calculator.




**M**: Displayed when there is something stored in the independent memory.
**[MEMO] ([IN])**: Displayed while the calculator is in the MEMO IN mode. [MEMO] only is displayed when you press the [MEMO] key to perform a search in a calculation mode.
**[EDIT]**: Displayed while you are editing data in the MEMO IN mode.
**BASE-N**: Displayed while the calculator is in the BASE-N mode.
**SD**: Displayed while the calculator is in the SD mode.
**LR**: Displayed while the calculator is in the LR mode.
**[D]**: Displayed while degrees are specified as the angle unit.
**[R]**: Displayed while radians are specified as the angle unit.
**[G]**: Displayed while grads are specified as the angle unit.
**ENG**: Displayed while the calculator is in the ENG mode.
**[S]**: Appears when you press the [SHIFT] key.
**[M]**: Appears when you press the [MODE] key.
**[A]**: Appears when you press the [ALPHA] key.
**hyp**: Appears when you press the [hyp] key.
**Disp**: Displayed which an intermediate calculation result is being shown.
**DEC**: Displayed while decimal input is specified for the BASE-N mode.
**HEX**: Displayed while hexadecimal input is specified for the BASE-N mode.
**BIN**: Displayed while binary input is specified for the BASE-N mode.
**OCT**: Displayed while octal input is specified for the BASE-N mode.
**FIX**: Displayed while the number of decimal places is specified.
**SCI**: Displayed while the number of significant digits is specified.
**← →**: Indicate that a display exceeds 12 characters. ← indicates that the display is continued off of the left side of the screen while → indicates that it continues off of the right.



## ■ Exponential Displays

The display can show calculation results only up to 10 digits long. When an intermediate value or a final result is longer, the calculator automatically switches over to exponential notation. Values greater than 9,999,999,999 are always displayed exponentially, while the lower limit is selectable. Note the following:

| Type | Lower limit | Upper limit |
|---|---|---|
| A (Norm 1) | 0.01 ($10^{-2}$) | 9,999,999,999 ($10^{10}$) |
| B (Norm 2) | 0.000000001 ($10^{-9}$) | 9,999,999,999 ($10^{10}$) |

Values less than the lower limits or greater than the upper limit shown above are displayed using exponential format.

Use the following procedure to switch between the Type A lower limit and the Type B lower limit:

① Check the display to see if the FIX or SCI symbols are shown, indicating that the number of significant digits or the number of decimal places have been specified. If either of the symbols is shown, press [MODE] [9] to cancel the specification.

② Perform the following calculation:

**1 [÷] 200 [EXE]**

③ Look at the display to see what the current lower limit is.

If the display reads:
$5.^{-03}$, the current setting is Type A

If the display reads:
0.005, the current setting is Type B

④ Press [MODE] [9] to switch between the Type A and Type B lower limits.

*Note that the lower limit is not changed if you press [MODE] [9] while the number of significant digits (SCI displayed) and/or the number of decimal places (FIX displayed) are specified. The first time you press [MODE] [9], you clear the FIX and SCI specifications, and so you must press [MODE] [9] again to change the lower limit.

### •Notes on Exponential Notation

A value that is expressed exponentially takes up much less space. To convert a positive value from exponential notation, look at the exponent for the number 10 in the exponential notation. Then move the decimal place of the value to the right, the same number of places, adding zeros as needed. For example:

1.2 11

Mantissa Exponent

➡ $1.2\times10^{11}$ ➡ 120,000,000,000

1.2

└ Delete

00000000000 ➡ 120000000000

└ 11 digits

$1.2\times10^{11}$

Negative values are handled the same way, except that you move the decimal place to the left instead of the right. For example:

1.2 -03

Mantissa Exponent

➡ $1.2\times10^{-3}$ ➡ 0.0012

1.2

└ Delete

0.000 ➡ 0.0012

└ 3 digits

$1.2\times10^{-3}$

You can find further information on the use of exponential notation on pages 10 and 30.

### •Hexadecimal and Sexagesimal Display Formats

The format used for the display of hexadecimal and sexagesimal values differs from the normal display because such values require letters and special symbols. Note the following:

**•Hexadecimal**

ABCDEF12

Indicates the hexadecimal value ABCDEF12.

**•Sexagesimal**

12°34'56.78''

Indicates the sexagesimal value 12 degrees (hours), 34 minutes, 56.78 seconds.

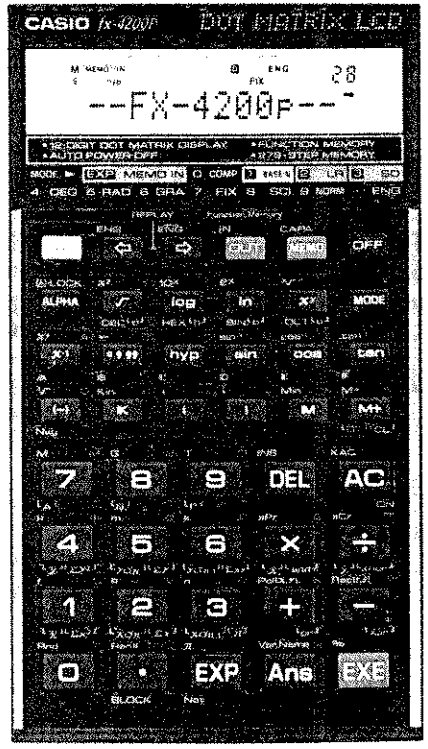


# 2/Before Using Your Calculator

Note the following safety precautions before using your calculator.

- Avoid damage to precision components by guarding your calculator against exposure to temperature extremes, high humidity, dust, sudden temperature changes, and strong impact. Low temperatures can slow down the display speed or even cause the display to fail completely. This is generally temporary, and normal operations should return at warmer temperatures.
- When the calculator is performing internal calculations, the display will clear and key operation will be impossible. Before entering data, check the display to confirm that the calculator is ready for further input.
- Never attempt your own maintenance or try to take the calculator apart.
- Never incinerate old batteries.
- Never use thinner, benzine or other volatile agents for cleaning. Clean the exterior of the calculator with a soft cloth that has been dampened with a solution of water and a mild neutral detergent.

# 3/General Guide



## [SHIFT] Shift key

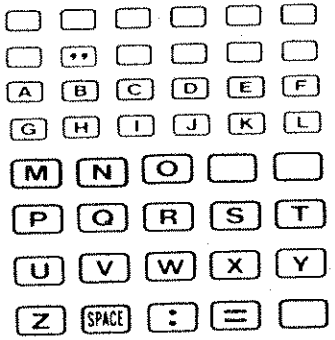
Changes the function of a key to the function marked in orange above the key. When you press [SHIFT] the [S] symbol appears on the display. Pressing [SHIFT] again while [S] is displayed cancels the shift and causes [S] to disappear from the display.

## [MODE] Mode key

Press this key followed by [EXP], [•], or [0] through [9] to set the mode of the calculator. See page 3 for details on the modes available.

## [A] LOCK [ALPHA] Alpha key

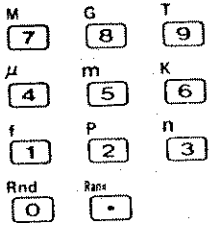
Changes the function of a key to input the letter or symbol marked in red above the key. When you press [ALPHA] the [A] symbol appears on the display. Press this key following [SHIFT] to lock the ALPHA function when you want to input a series of alphabetic characters. Pressing [ALPHA] again while [A] is displayed cancels the ALPHA function and causes [A] to disappear from the display.



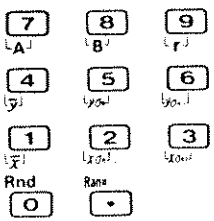

## Rnd Z [0] – T θ [9] r, Ran# SPACE [•] BLOCK Numeric keys

Use these keys to enter values.
Following the [SHIFT] key, the numeric keys perform the following functions. Following [SHIFT], the functions of these keys depend on the current mode of the calculator. Note the following:

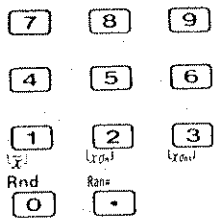
COMP mode ([MODE] [0])




LR mode ([MODE] [2])




SD mode ([MODE] [3])





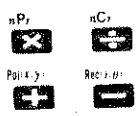

## π EXP Not Exponent / Pi / Not key

- Press this key after entering the mantissa part of a value when you are using exponential notation (i.e. $2.56 \times 10^{34} \rightarrow 2.56$ [EXP] 34).
- Following [SHIFT], this key enters the value for pi.
- In the BASE-N mode, use this key to input the logical Not.

## Pol(x, y) X Rec(r, θ) Y nPr S nCr T [+] [−] [×] [÷] Arithmetic operation keys

- Arithmetic operations are entered by pressing the keys in the same sequence as the operation is written, from left to right.
- The [+] and [−] keys can also be entered as sign of a value.
- The arithmetic operation keys perform the following functions when they are pressed following the [SHIFT] key:

COMP mode ([MODE] [0]), SD mode ([MODE] [3])




LR mode ([MODE] [2])

BASE-N mode ([MODE] [1])

## % EXE Execute / Percent key

- Press this key to execute a calculation and obtain its result. This key is also used to input data and to proceed to the next execution when an intermediate result is displayed.
- Following [SHIFT], this key performs percentage calculations. Note, however, that you cannot perform percentage calculations while the calculator is in the BASE-N mode.

## Ans Answer / Variable name key

- Press this key to recall the latest result obtained using the [EXE] key.
- Following [SHIFT], this key displays the name of the variable to which the currently displayed value is assigned (following a calculation that uses variables).

## INS DEL Delete / Insert key

- Press this key to delete the character flashing at the current location of the cursor. When the cursor is located at the end (far right) of the data, pressing this key deletes the character to the left of the cursor.
- Following [SHIFT], press this key to insert characters.

## KAC AC ON All Clear / Constant Memory Clear / Power ON key

- Use this key to clear the display of characters or error messages.
- Press this key following [SHIFT] to clear the statistical memories and constant memories.
- You can also use this key to switch power ON.

## ENG [←] ENG [→] Cursor / Replay / Engineering keys

- These keys move the cursor to the left [←] and right [→] to position it for editing of calculations or values. Holding either of the keys down causes the cursor to move at high speed in the respective direction.

- Immediately following operation of the [EXE] key, these keys take on a *replay* function. Pressing [⇨] positions the cursor at the beginning of the calculation you have just executed, while [⇦] positions the cursor at the end. Then you can execute the original calculation again, or edit it first and then execute it.
- Following [SHIFT], each press of these keys shifts the decimal of the displayed value three decimal places to the right or left. This in effect results in conversion of the value from one metric unit to another, such as $10^{3}$ milliseconds, $10^{6}$ microseconds, $10^{12}$ picoseconds, or $10^{3}$ kilohertz, $10^{6}$ megahertz, $10^{9}$ gigahertz.

**Example**

| | | |
|---|---|---|
| 12.3456 [EXE] | 12.3456 | |
| 1st [SHIFT] [ENG] | 12.3456 $^{00}$ | |
| 2nd [SHIFT] [ENG] | 12345.6 $^{03}$ | |
| 3rd [SHIFT] [ENG] | 12345600. $^{06}$ | |
| 4th [SHIFT] [ENG] | 12345600. $^{06}$ | (No change) |

| | | |
|---|---|---|
| 12.3456 [EXE] | 12.3456 | |
| 1st [SHIFT] [ENG] | 0.0123456 $^{03}$ | |
| 2nd [SHIFT] [ENG] | 0.000012345 $^{06}$ | |
| 3rd [SHIFT] [ENG] | 0.000000012 $^{09}$ | |
| 4th [SHIFT] [ENG] | 0.000000012 $^{09}$ | (No change) |

## [IN] [OUT] Formula Memory key

Use this key when performing calculations with the formula memory. See page 57 for details.

## [CAPA] [MEMO] Memo/Capacity key

- Press this key to recall the memo contents.
- Following [SHIFT], hold down this key to display the number of steps remaining in the memo area.

## [OFF] Power Off key

Press this key to switch the power of the calculator OFF. The current mode specification, memory contents and memo contents are all retained when power is off.

## [$x^2$ ''] [√‾] Square root/Square/Decimal key

- Press this key to calculate the square root of the displayed value.
- Following [SHIFT] this key squares the displayed value.
- In the BASE-N mode, pressing this key specifies that calculations are to be performed using decimal values ("DEC" displayed).
- Following [SHIFT] in the BASE-N mode, specifies that the next value entered is a decimal value.



## [$10^x$] [log] Common logarithm/Common antilogarithm/Hexadecimal key

- Press this key to determine the common logarithm (base 10) of a value.
- Following [SHIFT], press this key to calculate the common antilogarithm ($x$th power of 10).
- In the BASE-N mode, pressing this key specifies that calculations are to be performed using hexadecimal values ("HEX" displayed).
- Following [SHIFT] in the BASE-N mode, specifies that the next value entered is a hexadecimal value.

## [$e^x$] [ln] Natural Logarithm/Exponential/Binary key

- Press this key to calculate the natural logarithm (base $e$) of a value.
- Following [SHIFT], press this key to calculate the $x$th power of $e$.
- In the BASE-N mode, pressing this key specifies that calculations are to be performed using binary values ("BIN" displayed).
- Following [SHIFT] in the BASE-N mode, specifies that the next value entered is a binary value.

## [$y^x$] [$x^y$] Power/Root/Octal key

- Press this key to calculate $x$ (any value) to the $y$th (any value) power.
- Enter a value for $x$, followed by [SHIFT], and then a value for $y$ calculate the $x$th root of $y$.
- In the BASE-N mode, pressing this key specifies that calculations are to be performed using octal values ("OCT" displayed).
- Following [SHIFT] in the BASE-N mode, specifies that the next value entered is a octal value.

## [$x!$ A] [$x^{-1}$] Inverse/Factorial key

- Press this key to calculate the inverse of a displayed value.
- Following [SHIFT], press this key to calculate the factorial of the displayed value.
- In the BASE-N mode, press this key to enter the hexadecimal value A.

## [← B] [°‘“] Decimal ↔ Sexagesimal Conversion key

- When inputting a sexagesimal value, press this key after each part (degree or hour, minute, second) of the value. To enter 78°45'12", press: 78 [°‘“] 45 [°‘“] 12 [°‘“].
- Following [SHIFT], press this key to convert a displayed decimal value to its sexagesimal equivalent.
- In the BASE-N mode, press this key to enter the hexadecimal value B.

## [C] [hyp] Hyperbolic key

- Press this key to obtain the corresponding hyperbolic functions when it is pressed before the [sin] (sinh), [cos] (cosh), and [tan] (tanh) keys.
- Following [SHIFT] (as in [SHIFT] [hyp] [sin]), this key obtains the inverse hyperbolic functions for [sin] ($\sinh^{-1}$), [cos] ($\cosh^{-1}$), and [tan] ($\tanh^{-1}$).
- In the BASE-N mode, press this key to enter the hexadecimal value C.

## [D] [sin] Sine/Arc sine key

- Press this key before entering a value to calculate the sine of the value.
- Following [SHIFT], press this key before entering a value to calculate the arc sine of the value.
- In the BASE-N mode, press this key to enter the hexadecimal value D.

### cos E [cos] Cosine/Arc cosine key

- Press this key before entering a value to calculate the cosine of the value.
- Following [SHIFT], press this key before entering a value to calculate the arc cosine of the value.
- In the BASE-N mode, press this key to enter the hexadecimal value E.

### tan F [tan] Tangent/Arc tangent key

- Press this key before entering a value to calculate the tangent of the value.
- Following [SHIFT], press this key before entering a value to calculate the arc tangent of the value.
- In the BASE-N mode, press this key to enter the hexadecimal value F.

### √ G [(-)] Sign Change/Cube Root/Negative key

Neg

- Press this key before entering a value to specify that the value is negative.
- Following [SHIFT] press this key before entering a value to calculate the cube root of the value.
- In the BASE-N mode, this key returns the negative (two's complement) of a value.

### Kin H [IK] Constant Memory Output/Input key

- Press this key to recall values stored in constant memories 1 through 6. To recall a value stored in constant memory 5, for example, press: [IK] [5].
- Press this key following [SHIFT] to input values into constant memories 1 through 6. To enter 12.3 into constant memory 3, for example, press: 12.3 [SHIFT] [Kin] [3].

### , I [(] Open Parenthesis/Comma key

- Press this key to enter an open parenthesis.
- Following [SHIFT], press this key to enter a comma.

### : J [)] Close Parenthesis/Semicolon key

- Press this key to enter a close parenthesis.
- Following [SHIFT], press this key to enter a semicolon.

### Min K [IM] Memory Recall/Memory In key

- Press this key to display the value stored in the independent memory without changing the memory contents.
- Following [SHIFT], this key stores the displayed value in the independent memory. At this time, any value previously stored in the independent memory is lost (i.e. replaced with the new value).

### M− L [M+] Memory Plus/Memory Minus/Data Input/Data Delete key

DT CL

- Press this key to add a value to the contents of the independent memory. The value added to the independent memory can either be entered, or it can be the result of an arithmetic operation executed using this key (in place of [EXE]).
- Following [SHIFT], this key subtracts the displayed value from the contents of the independent memory.
- In the LR mode ([MODE] [2]) and SD mode ([MODE] [3]), pressing this key following a data item enters it.
- Following [SHIFT] in the LR mode ([MODE] [2]) and SD mode ([MODE] [3]), this key deletes the data item specified.



**Example**

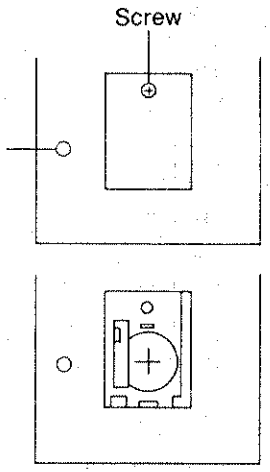
DATA A [DT] DATA B [DT] DATA C [DT] enters data items A, B, and C.
DATA B [SHIFT] [CL] deletes data item B.

## 4/About the Power Supply

- Your calculator is powered by a single lithium batteries (CR2032). If the display becomes dim and difficult to read, it probably means that your battery is weak and should be replaced.
- To avoid damage caused by a leaking battery, be sure to replace it at least once every two years, regardless of how much you used the calculator during that time.
- Contents of the calculator's memory may be erased when you change batteries. Be sure to make a record of any data contained in memory before you replace batteries.

### ■ Replacing Batteries

① Switch the power of the calculator OFF, and use a screwdriver to remove the screw on the back of the calculator that holds the battery compartment cover in place. Remove the battery compartment cover.




② Remove the old battery by turning the calculator so that the open battery compartment is facing downwards, and tapping gently on the calculator.
③ Wipe the surfaces of a new battery with a soft cloth, and load it into the battery compartment, ensuring that its positive ⊕ pole is facing up.
④ Replace the battery compartment cover and secure it in place with its screw.
⑤ Press the All Reset button on the back of the calculator.

**PRECAUTIONS:**

Incorrectly using batteries can cause leakage or bursts, and may damage your product. Note the following precautions:

① Be sure that + / − polarity is correct.
② Never leave dead battery in battery compartment as it may cause malfunctions.
③ Remove battery when not using the product for extended period.
④ It is recommended that battery be replaced once every 2-year to prevent the chance of malfunction.
⑤ The supplied battery is not rechargeable.
⑥ Do not expose the battery to direct heat, let it become shorted or try to take it apart. (Keep batteries out of the reach of small children. If swallowed, consult a doctor immediately.)

## ■ Auto Power OFF Function

This unit automatically switches OFF if not operated for approximately 6 minutes. Power can be restored by pressing the [AC ON] key. Memory contents and mode setting are retained even when power is switched off.

# 5/Helpful Hints for Easier Calculations

The information given in this section should help you to understand the internal workings of the calculator, so you can enter data in the most efficient manner.

## ■ Order of Operations

Operations are performed in the following order of precedence:

① Coordinate conversions
Pol $(x, y)$, Rec $(r, \theta)$

② Type A functions
These functions are those in which the value is entered and then the function key is pressed.
$x^2$, $x^{-1}$, $x!$, °' '', engineering symbols

③ Power, root
$x^y$, $\sqrt[x]{\ }$

④ π, memory, abbreviated multiplication format (see page 21) immediately before variables.
2π, 4 Ⅸ 1, 5A, πR ...

⑤ Type B functions
These functions are those in which the function key is pressed and then the value is entered.
$\sqrt{\ }$, $\sqrt[3]{\ }$, log, ln, $e^x$, $10^x$, sin, cos, tan, $\sin^{-1}$, $\cos^{-1}$, $\tan^{-1}$, sinh, cosh, tanh, $\sinh^{-1}$, $\cosh^{-1}$, $\tanh^{-1}$, (—), ( ), d, h, b, o, Neg, Not

⑥ Abbreviated multiplication format (see page 21) immediately before Type B functions.
$2\sqrt{3}$, A log2 ...

⑦ Permutation, combination
$_nP_r$, $_nC_r$

⑧ ×, ÷

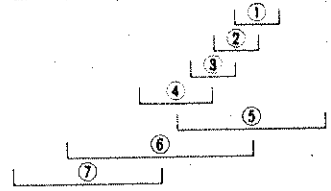
⑨ +, −

⑩ and
⑪ or, xor, xnor
] BASE-N mode only.

*When multiple functions are of the same precedence, they are performed from right to left. Normal calculations are performed from left to right.
*Complex functions are performed from right to left.
*Terms contained in parentheses receive the highest precedence.



**Example** $2+3\times(\log\sin 2\pi^2\,\text{rad}+6.8)=22.07101691$



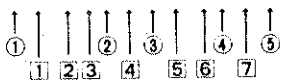

## ■ About Stacks

A ***stack*** is an area of memory used to temporarily store data. If you visualize the memory as a series of boxes piled vertically, you can see how such an area came to be called a ***stack.***
When your calculator processes a calculation, it divides its contents into two different stacks: a ***numeric stack*** for values, and a ***command stack*** for commands. The numeric stack has a capacity of eight levels (boxes), while the capacity of the command stack is 16 levels. A stack overflow error (indicated by Stk ERROR on the display) will occur if your calculation exceeds these limitations.

**Example**

The following example shows how the calculator assigns values and commands to their respective stacks:

$2\times((3+4\times(5+4)\div 3)\div 5)+8=$




**Numeric stack**

| | |
|---|---|
| ① | 2 |
| ② | 3 |
| ③ | 4 |
| ④ | 5 |
| ⑤ | 4 |
| ⋮ | |

**Command stack**

| | |
|---|---|
| 1 | × |
| 2 | ( |
| 3 | ( |
| 4 | + |
| 5 | × |
| 6 | ( |
| 7 | + |
| ⋮ | |

*The calculation is performed in accordance with the order of precedence described in the preceding section. Once a calculation is performed, the stacks are cleared.

## ■ About Input and Display Limitations

The maximum size of a value that you can enter is 10 digits for the mantissa and 2 digits for the exponent. Internally, calculations are performed using a 12-digit mantissa and a 2-digit exponent. Once you complete a calculation, the result is internally rounded off to 10 digits and displayed. If you continue the calculation, the displayed (10-digit) value is used by the calculator for subsequent operations.

## ■ About Overflows and Errors

When predetermined calculation ranges are exceeded, the calculator will display an ERROR message and disable any further calculation. This will occur in the following cases:

① If an intermediate result (arithmetic, scientific functions, statistical) or a value stored in a memory exceeds $\pm 9.999999999 \times 10^{99}$ (Ma ERROR). Values stored in memory prior to the overflow are retained.

② If a function calculation exceeds the input range shown on page 67 (Ma ERROR).

③ If an error is made in operation during statistical calculation (Ma ERROR).

**Example**

If $\bar{x}$ or $x\sigma n$ is obtained when $n = 0$.

④ If the capacity of the numeric or command stack is exceeded (Stk ERROR) (see page 16).

**Example**

Pressing the [(] key 15 times and then performing the calculation $2 + 3 \times 4$.

⑤ If a calculation is entered incorrectly (Syn ERROR).

**Example**

Entering 5 [+] [+] 3 [EXE]

⑥ If more than eight different variables are used in a single calculation (Mem ERROR).

⑦ If the number of memo steps available for storage (279 steps) is exceeded (Mem ERROR).

## ■ Understanding Steps

The size of a calculation is measured in ***steps***, with each step representing a value or calculation command. In some cases, one step is the same as one value or one key operation as in the case of arithmetic operators such as [+], [−], [×], and [÷]. In other cases, two key operations represent a single function, and, therefore, one step, such as [SHIFT] [$x^2$]. If you ever have a doubt about what makes up a step, press the [◁] or [▷] cursor key. Each press will cause the cursor to move the equivalent of one step on the display.

Your calculator has a capacity of 63 steps. After you input 57 steps the flashing "_" cursor changes to " ■ " to indicate that you are reaching the limit. Calculations longer than 63 steps can be accomplished by breaking them down into smaller separate calculations, and performing them in series.

* Values and commands are flush with the left side of the display as you enter them, while results are flush right.



## ■ Making Corrections

• Use the [◁] and [▷] cursor keys to locate the cursor at the position to be modified and enter the desired value or function.

**Example** $122 + 456 \rightarrow 123 + 456 =$

| | |
|---|---|
| [1] [2] [2] | 122_ |
| [◁] | 12**2** |
| [3] | 123_ |

**Example** $\cos 60 \rightarrow \sin 60$

| | |
|---|---|
| [cos] [6] [0] | cos 60_ |
| [◁] [◁] [◁] | c**o**s 60 |
| [sin] | sin **6**0 |

* After changes, you can execute the new calculation by pressing [EXE], or you can move the cursor back to the right of the calculation and continue to enter more values or functions.

• For deletion, use the [◁] and [▷] cursor keys to locate the cursor at the position of the deletion and press the [DEL] key. Each press of [DEL] deletes one command or value (i.e. one step).

**Example** $369 \times \times 2 \rightarrow 369 \times 2$

| | |
|---|---|
| [3] [6] [9] [×] [×] [2] | 369 × × 2_ |
| [◁] [◁] [DEL] | 369 × **2** |

• For insertion, use the [◁] and [▷] cursor keys to locate the cursor at the position of the insertion and press [SHIFT] [INS]. This will enter the insert mode at the cursor's location, indicated by "[ ]". You can then insert commands or values at the position of the "[ ]".

**Example** $2.36^2 \rightarrow \sin 2.36^2$

| | |
|---|---|
| [2] [·] [3] [6] [SHIFT] [$x^2$] | $2.36^2$_ |
| [◁] [◁] [◁] [◁] [◁] | $2.36^{2}$ |

[SHIFT] [INS]

[sin]

2,36²

sin 2,36²

*You can exit the insert mode by pressing [←], [→], [SHIFT] [INS], or [EXE].

## ■ About Memories

Your calculator comes equipped with one ***independent memory*** and a total of 6 ***constant memories.***

### •Independent Memory

The independent memory comes in handy when you want to perform a series of additions and subtractions and then look at the result.

**Example**

Store the value 123 in the independent memory.

**123** [SHIFT] [Min]

M 123.

Recall the contents of the independent memory.

[M] [EXE]

M 123.

Add 25 to and subtract 12 from the independent memory.

**25** [M+] **12** [SHIFT] [M−]

(This operation can also be performed as 25 − 12 [M+])

M 12.

Recall the contents of the independent memory.

[M] [EXE]

M 136.

M disappears from the display.

↓

Clear the independent memory.

**0** [SHIFT] [Min]

0.

*Addition to (M+) and subtraction from (M−) the independent memory cannot be performed while the calculator is in the SD or LR mode.

**Important**

•Note that there is an important difference between [Min] and [M+] / [M−].
If you press [Min], the currently displayed value is stored in the independent memory as it is, clearing anything that was in the memory previously. [M+], on the other hand, adds the currently displayed value to the value that is stored in the independent memory. Likewise, [M−] subtracts the displayed value.



### •Constant Memories

Six constant memories are available for storage of values which can then be recalled whenever you need them.

**Example**

Assign the value 123 to constant memory 1.

**123** [SHIFT] [Kin] [1]

123.

Add 30 to the value in constant memory 1 and store the result in constant memory 2.

[IK] [2] [ALPHA] [=] [IK] [1] [+] **30**

153.

Recall the contents of constant memory 2.

[IK] [2] [EXE]

153.

Clear constant memory 1.

**0** [SHIFT] [Kin] [1]

0.

Clear all of the constant memories.

[SHIFT] [KAC]

_

*In the SD and LR modes, the constant memories are used as statistical memories, and so cannot be used during statistical calculations.

## ■ Answer (Ans) Function

The ***Answer*** function automatically stores the last value entered or calculation result obtained by pressing [EXE]. You can recall the latest value stored by the Answer function by pressing the [Ans] key.
The Answer function even lets you incorporate results of a past execution into calculations. When you press the [Ans] key, the indicator "Ans" appears within the calculation to indicate that the current contents of the Answer function memory will be inserted at that point.

**Example** 123 + 456 = 579

789 − 579 = 210

[1] [2] [3] [+] [4] [5] [6] [EXE]

579.

[7] [8] [9] [−] [Ans]

789 − Ans_

[EXE]

210.

A value stored by the Answer function can have a mantissa up to 12 digits long and 2-digit exponent. The Answer function value is not cleared when you press the AC key or when you switch the power of the calculator OFF. The current Answer function value is replaced whenever you press the EXE, %, M+, M−, Min, Ans 1 – 6 key. If the execution of a calculation is stopped by an error, the Answer function memory retains the value it contained before execution of the erroneous calculation.

## ■ Abbreviated Multiplication Format

You can perform multiplication with certain functions and memories without entering the multiplication sign. Note the following:

- Before the following functions
  sin, cos, tan, $\sin^{-1}$, $\cos^{-1}$, $\tan^{-1}$, sinh, cosh, tanh, $\sinh^{-1}$, $\cosh^{-1}$, $\tanh^{-1}$, log, ln, $10^x$, $e^x$, $\sqrt{\ }$, $\sqrt[3]{\ }$, Pol $(x, y)$, Rec $(r, \theta)$

**Example**

2sin30, 10log1.2, $2\sqrt{3}$, 2Pol(5, 12) .....

- Before constant, variable and memories

**Example**

$2\pi$, 2AB, 5 M, 4 K 2, 3Ans .....

- Before open parenthesis

**Example**

3(5 + 6), (A + 1)(B − 1) ....



# 6/Performing Basic Calculations

## ■ Arithmetic Operations

- Enter arithmetic operations just as they are written, from left to right.
- To enter a negative value, press (−) before you enter the value.

| Example | Operation | Display |
|---|---|---|
| 23 + 4.5 − 53 = −25.5 | 23 + 4.5 − 53 EXE | −25.5 |
| 56 × (−12) ÷ (−2.5) = 268.8 | 56 × (−) 12 ÷ (−) 2.5 EXE | 268.8 |
| 12369 × 7532 × 74103 = 6.903680613 × $10^{12}$ (6903680613000) | 12369 × 7532 × 74103 EXE | 6.903680613$^{12}$ |
| (4.5 × $10^{75}$) × (−2.3 × $10^{-79}$) = −1.035 × $10^{-3}$ (−0.001035) | 4.5 EXP 75 × (−) 2.3 EXP (−) 79 EXE | −1.035$^{03}$ |
| (1 × $10^5$) ÷ 7 = 14285.71429 | 1 EXP 5 ÷ 7 EXE | 14285.71429 |
| (1 × $10^5$) ÷ 7 − 14285 = 0.7142857 | 1 EXP 5 ÷ 7 − 14285 EXE | 0.7142857 |

*Internal calculations are performed using a 12-digit mantissa, and results are rounded off to 10-digits. The original 12-digit, however, is retained internally.

### •Mixed Arithmetic Calculations

Multiplication and division are given precedence over addition and subtraction.

| Example | Operation | Display |
|---|---|---|
| 3 + 5 × 6 = 33 | 3 + 5 × 6 EXE | 33. |
| 7 × 8 − 4 × 5 = 36 | 7 × 8 − 4 × 5 EXE | 36. |
| 1 + 2 − 3 × 4 ÷ 5 + 6 = 6.6 | 1 + 2 − 3 × 4 ÷ 5 + 6 EXE | 6.6 |

## ■ Using Parentheses

| Example | Operation | Display |
|---|---|---|
| $100-(2+3)\times 4=80$ | 100 − ( 2 + 3 ) × 4 EXE | 80. |
| $2+3\times(4+5)=29$ | 2 + 3 × ( 4 + 5 EXE | 29. |
| *You can omit any closed parenthesis immediately preceding the EXE key. | | |
| $(7-2)\times(8+5)=65$ | ( 7 − 2 ) ( 8 + 5 EXE | 65. |
| *You can omit multiplication signs in front of open parentheses. | | |
| $10-\{2+7\times(3+6)\}=-55$ | 10 − ( 2 + 7 ( 3 + 6 EXE | −55. |
| $\frac{2\times3+4}{5}=(2\times3+4)\div5=2$ | ( 2 × 3 + 4 ) ÷ 5 EXE | 2. |
| $\frac{5\times6+6\times8}{15\times4+12\times3}=0.8125$ | ( 5 × 6 + 6 × 8 ) ÷ ( 15 × 4 + 12 × 3 ) EXE | 0.8125 |
| $(1.2\times10^{19})-\{(2.5\times10^{20})\times\frac{3}{100}\}=4.5\times10^{18}$ | 1.2 EXP 19 − ( 2.5 EXP 20 × 3 ÷ 100 ) EXE | $4.5^{18}$ |
| $\frac{6}{4\times5}=0.3$ | 6 ÷ ( 4 × 5 ) EXE | 0.3 |
| *The above is the same as 6 ÷ 4 ÷ 5 EXE. | | |



## ■ Specifying the Number of Decimal Places and the Number of Significant Digits

- Specify the number of decimal places (FIX) by the operation MODE 7 *n*, where *n* is a value from 0 through 9. The indicator FIX is shown on the display while a decimal place specification is in effect.
- Specify the number of significant digits (SCI) by the operation MODE 8 *n*, where *n* is a value from 0 through 9. In the case of the SCI, 0 is regarded as 10. The indicator SCI is shown on the display while a significant digit specification is in effect.
- You can also move the decimal place of a displayed value three places to the left and right by using the SHIFT ENG (or SHIFT ENG) key (see page 25).
- The specifications you make for FIX and SCI are retained (even when power is switched off) until you change them with a new specification, or you clear them by MODE 9.
- You can use the operation MODE 9 to not only clear the FIX or SCI specifications, but also to specify the lower limit for exponential display. Each time you press MODE 9 while there is no FIX or SCI specification, the calculator switches between Norm 1 and Norm 2.

Norm 1:
Automatic exponential display for values less than $10^{-2}$ or greater than $10^{9}$.

Norm 2:
Automatic exponential display for values less than $10^{-9}$ or greater than $10^{9}$.

- No matter what you specify for FIX and SCI, calculations within the calculator are always performed using a 12-digit mantissa. If you want to convert the value used inside the calculator to a value having the specified number of digits, press SHIFT Rnd EXE.
- The above specifications are not valid in the BASE-N mode.

| Example | Operation | Display |
|---|---|---|
| $100\div6=16.66666666\ldots$ | 100 ÷ 6 EXE | 16.66666667 |
| | (Specifies 4 decimal places.) MODE 7 4 | 16.6667 |
| | (Clears the specification.) MODE 9 | 16.66666667 |
| | (Specifies 5 significant digits.) MODE 8 5 | $1.6667^{01}$ |
| | (Clears the specification.) MODE 9 | 16.66666667 |
| *Both the FIX and SCI specifications can be changed at any time, even during a calculation sequence. | | |
| *Values are displayed rounded off to the number of places specified. | | |
| $1\div1000=0.001$ $=1\times10^{-3}$ | (Norm 1) 1 ÷ 1000 EXE | $1.^{-03}$ |
| | (Norm 2) MODE 9 | 0.001 |

| | | |
|---|---|---|
| $200 \div 7 \times 14 = 400$ | 200 ÷ 7 × 14 EXE | 400. |
| | (Specifies 3 decimal places.) MODE 7 3 | 400.000 |
| | (Continuing with the displayed 10-digit value) 200 ÷ 7 EXE | 28.571 |
| | × | 8.57142857 × _ |
| | 14 EXE | 400.000 |
| | Performing the same calculation with the specified number of significant digits: | |
| | 200 ÷ 7 EXE | 28.571 |
| | (Internal rounding) SHIFT Rnd | 28.571 |
| | × | 28.571 × _ |
| | 14 EXE | 399.994 |
| | (Clears the specification.) MODE 9 | 399.994 |
| $123\text{m} \times 456 = 56088\text{m}$ | 123 × 456 EXE | 56088. |
| $= 56.088\text{km}$ | SHIFT ENG | $56.088^{03}$ |
| $78\text{g} \times 0.96 = 74.88\text{g}$ | 78 × 0.96 EXE | 74.88 |
| $= 0.07488\text{kg}$ | SHIFT ENG | $0.07488^{03}$ |



# 7/Special Functions

## ■ Continuous Calculation Function

The ***Continuous Calculation Function*** lets you use the result of one calculation as an element of a successive calculation. Such calculations are performed using the 10-digit mantissa of the displayed value.

**Example** $3 \times 4 = 12$ continuing to $\div 3.14 =$

| | |
|---|---|
| 3 × 4 EXE | 12. |
| (continuing) ÷ 3.14 | 12 ÷ 3.14_ |
| EXE | 3.821656051 |

**Example** $1 \div 3 \times 3 =$

| | |
|---|---|
| 1 ÷ 3 × 3 EXE | 1. |
| 1 ÷ 3 EXE | 0.3333333333 |
| (continuing) × 3 EXE | 0.9999999999 |

This function can also be used to store a result to memory, with Type A functions (see page 15), or with $+$, $-$, $x^y$, $\sqrt[x]{\ }$, $^\circ\ '\ ''$.

**Example** To store the result of $12 \times 45$ to Memory **IK** 1.

| | |
|---|---|
| 12 × 45 EXE | 540. |
| (continuing) SHIFT Kin 1 | 540. |

**Example** To square the result of $78 \div 6$ (see page 34)

| | |
|---|---|
| 78 ÷ 6 EXE | 13. |
| (continuing) SHIFT $x^2$ | $13.^2$_ |
| EXE | 169. |

## ■ Using the Replay Function

•Press either of the cursor keys after executing a calculation to display the calculation again. Pressing ⇨ positions the cursor at the beginning of the calculation you have just executed, while ⇦ positions the cursor at the end. Then you can move through the calculations using the ⇨ and ⇦ cursor keys to confirm that it is correct or to make changes. Finally, you can execute the original calculation again, or edit it first and then execute it.

**Example**

| | |
|---|---|
| 123 × 456 EXE | 56088. |
| ⇨ | 123 × 456 |
| EXE | 56088. |
| ⇦ | 123 × 456_ |

**Example** $4.12 \times 3.58 + 6.4 = 21.1496$
$4.12 \times 3.58 - 7.1 = 7.6496$

| | |
|---|---|
| 4.12 × 3.58 + 6.4 EXE | 21.1496 |
| ⇦ | ↖12 × 3.58 + 6.4_ |
| ⇦⇦⇦⇦ | 4.12 × 3.58 + 6.↗ |
| − 7.1 | ↖12 × 3.58 − 7.1_ |
| EXE | 7.6496 |

### •Error Location Function

•When an error occurs during a calculation, the most obvious solution would be to clear the calculator by pressing the AC key, and then input the formula again. With the Replay function, you can press the ⇦ or ⇨ cursor key, make the necessary changes, and then execute the new, correct calculation.

**Example** To correct the calculaiton $14 \div 10 \times 2.3$ EXE, mistakenly entered as: $14 \div 0 \times 2.3$ EXE.

| | |
|---|---|
| 14 ÷ 0 × 2.3 EXE | Ma ERROR |
| ⇨ (or ⇦) | 14 ÷ 0 × 2.3 |
| | ↑ (Error occurred) |



| | |
|---|---|
| ⇦ SHIFT INS 1 | 14 ÷ 10 × 2.3 |
| EXE | 3.22 |

•The Replay function is cleared when you switch modes, or when you recall a memo.
•The Replay function is retained after pressing the AC key or OFF key.

## ■ Using Multistatements

•You can use the ***Multistatement Function*** to connect multiple formulas into a single statement. Formulas are separated by colons (ALPHA :).
•When execution reaches a colon, the calculator displays the intermediate result up to that point until the EXE key is pressed to resume execution.

**Example**

| | |
|---|---|
| 4 × 8 ALPHA : 5 ÷ 2 ALPHA : 12 − 4 | ↖× 8 : 5 ÷ 2 : 12 − 4_ |
| EXE | Ans 32. |
| EXE | Ans 2.5 |
| EXE | 8. |

•You cannot perform continuous calculations (see page 26) within multistatements.

**Example** $123 \times 456 : \times 5$
Illegal

# 8/Scientific Function Calculations

## ■ Performing Trigonometric and Inverse Trigonometric Functions

- Use the operation MODE 4 – 6 to specify the unit of angular measurement (deg, rad, grad) to be used for trigonometric and inverse trigonometric calculations.
- The unit of angular measurement specification is retained (even if power is switched off) until you make another specification.
- You cannot specify the unit of angular measurement (degrees, radians, grads) or the display format (FIX, SCI) while the calculator is in the BASE-N mode. Such specifications can only be made if you first exit the BASE-N mode.
- The operations noted below are not possible in the BASE-N mode.

| Example | Operation | Display |
|---|---|---|
| $\sin 63°52'41'' = 0.897859012$ | MODE 4 → "D"<br>sin 63 ° ' ' 52 ° ' ' 41 ° ' ' EXE | 0.897859012 |
| $\cos\left(\frac{\pi}{3}\text{ rad}\right) = 0.5$ | MODE 5 → "R"<br>cos ( SHIFT π ÷ 3 ) EXE | 0.5 |
| $\tan(-35\text{gra}) = -0.6128007881$ | MODE 6 → "G"<br>tan (−) 35 EXE | −0.6128007881 |
| $2\cdot\sin 45° \times \cos 65° = 0.5976724775$ | MODE 4 → "D"<br>2 × sin 45 × cos 65 EXE<br>(May be omitted) | 0.5976724775 |
| $\sin^{-1}0.5 = 30°$<br>(Determines $x$ for $\sin x = 0.5$) | SHIFT sin 0.5 EXE<br>(May also be entered as .5) | 30. |
| $\cos^{-1}\frac{\sqrt{2}}{2} = 0.7853981634\text{ rad} = \frac{\pi}{4}\text{ rad}$ | MODE 5 → "R"<br>SHIFT cos ( √ 2 ÷ 2 ) EXE<br>÷ SHIFT π EXE | 0.7853981634<br>0.25 |
| $\tan^{-1}0.741 = 36.53844577° = 36°32'18.4''$ | MODE 4 → "D"<br>SHIFT tan 0.741 EXE<br>SHIFT ° ' ' ' | 36.53844577<br>36°32'18.4'' |
| *When the degree / minute / second value exceeds 11 digits, the display will cut off the value to the right. The entire value is stored internally (in decimal format) for calculations. | | |
| $2.5 \times (\sin^{-1}0.8 - \cos^{-1}0.9) = 68°13'13.53''$ | 2.5 × ( SHIFT sin 0.8 − SHIFT cos 0.9 ) EXE SHIFT ° ' ' ' | 68°13'13.53'' |



## ■ Performing Logarithmic and Exponential Functions

- The operations noted below are not possible in the BASE-N mode.

| Example | Operation | Display |
|---|---|---|
| $\log 1.23\ (\log_{10}1.23) = 8.99051114 \times 10^{-2}$ | log 1.23 EXE | 0.0899051114 |
| $\ln 90\ (\log 90) = 4.49980967$ | ln 90 EXE | 4.49980967 |
| $\log 456 \div \ln 456 = 0.4342944819$ | log 456 ÷ ln 456 EXE | 0.4342944819 |
| $10^{1.23} = 16.98243652$<br>(To determine the antilogarithm of common logarithm 1.23) | SHIFT $10^x$ 1.23 EXE | 16.98243652 |
| $e^{4.5} = 90.0171313$<br>(To determine the antilogarithm of natural logarithm 4.5) | SHIFT $e^x$ 4.5 EXE | 90.0171313 |
| $10^4 \cdot e^{-4} + 1.2 \cdot 10^{2.3} = 422.5878667$ | SHIFT $10^x$ 4 ×<br>SHIFT $e^x$ (−) 4 + 1.2 ×<br>SHIFT $10^x$ 2.3 EXE | 422.5878667 |
| $5.6^{2.3} = 52.58143837$ | 5.6 $x^y$ 2.3 EXE | 52.58143837 |
| $\sqrt[7]{123}\ (= 123^{\frac{1}{7}}) = 1.988647795$ | 7 SHIFT $\sqrt{\ }$ 123 EXE | 1.988647795 |
| $(78-23)^{-12} = 1.305111829 \times 10^{-21}$ | ( 78 − 23 ) $x^y$ (−) 12 EXE | 1.305111829 -21 |
| $2+3\times\sqrt[3]{64}-4=10$ | 2 + 3 × 3 SHIFT $\sqrt{\ }$ 64 − 4 EXE | 10. |
| $2\times 3.4^{(5+6.7)} = 3306232$ | 2 × 3.4 $x^y$ ( 5 + 6.7 ) EXE | 3306232. |

## ■ Performing Hyperbolic and Inverse Hyperbolic Functions

•The operations noted below are not possible in the BASE-N mode.

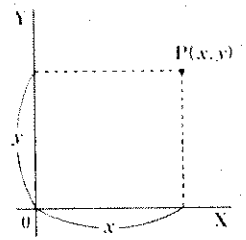
| Example | Operation | Display |
|---|---|---|
| $\sinh 3.6 = 18.28545536$ | hyp sin 3.6 EXE | 18.28545536 |
| $\cosh 1.23 = 1.856761057$ | hyp cos 1.23 EXE | 1.856761057 |
| $\tanh 2.5 = 0.9866142982$ | hyp tan 2.5 EXE | 0.9866142982 |
| $\cosh 1.5 - \sinh 1.5 = 0.2231301602 = e^{-1.5}$ (Proof of $\cosh x \pm \sinh x = e^{\pm x}$) | hyp cos 1.5 − hyp sin 1.5 EXE (Continuing) In Ans EXE | 0.2231301602 −1.5 |
| $\sinh^{-1}30 = 4.094622224$ | hyp SHIFT sin 30 EXE | 4.094622224 |
| $\cosh^{-1}\left(\frac{20}{15}\right) = 0.7953654612$ | hyp SHIFT cos ( 20 ÷ 15 ) EXE | 0.7953654612 |
| To calculate $x$ when $\tanh 4x = 0.88$ $x = \frac{\tanh^{-1}0.88}{4} = 0.3439419141$ | hyp SHIFT tan 0.88 ÷ 4 EXE | 0.3439419141 |
| $\sinh^{-1}2 \times \cosh^{-1}1.5 = 1.389388923$ | hyp SHIFT sin 2 × hyp SHIFT cos 1.5 EXE | 1.389388923 |
| $\sinh^{-1}\left(\frac{2}{3}\right) + \tanh^{-1}\left(\frac{4}{5}\right) = 1.723757406$ | hyp SHIFT sin ( 2 ÷ 3 ) + hyp SHIFT tan ( 4 ÷ 5 ) EXE | 1.723757406 |

## ■ Performing Coordinate Conversions (Pol, Rec)

•Your scientific calculator lets you convert between rectangular coordinates and polar coordinates.



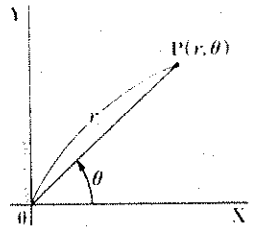
•Rectangular coordinates




Pol

Rec

•Polar coordinates




•Calculations results are automatically stored in memories K5 and K6. Following a calculation, the value stored in K5 is displayed, and you can recall the value stored in K6 using the operation IK 6 EXE.

| | K5 | K6 |
|---|---|---|
| Pol | $r$ | $\theta$ |
| Rec | $x$ | $y$ |

•The value of $\theta$ can be determined in the range of $-180° < \theta \leqq 180°$. The same range is also applicable for both radians and grads.

| Example | Operation | Display |
|---|---|---|
| To calculate $r$ and $\theta$ when $x = 14$ and $y = 20.7$ | MODE 4 → "D" SHIFT Pol( 14 SHIFT , 20.7 ) EXE (Continuing) IK 6 EXE SHIFT ⇄ | 24.98979792 ($r$) 55°55′42.2″ ($\theta$) |
| To calculate $r$ and $\theta$ rad when $x = 7.5$ and $y = -10$ | MODE 5 → "R" SHIFT Pol( 7.5 SHIFT , (−) 10 ) EXE (Continuing) IK 6 EXE | 12.5 ($r$) −0.927295218 ($\theta$) |
| To calculate $x$ and $y$ when $r = 25$ and $\theta = 56°$ | MODE 4 → "D" SHIFT Rec( 25 SHIFT , 56 ) EXE (Continuing) IK 6 EXE | 13.97982259 ($x$) 20.72593931 ($y$) |
| To calculate $x$ and $y$ when $r = 4.5$ and $\theta = \frac{2}{3}\pi$ rad | MODE 5 → "R" SHIFT Rec( 4.5 SHIFT , ( 2 ÷ 3 × SHIFT π ) ) EXE (Continuing) IK 6 EXE | −2.25 ($x$) 3.897114317 ($y$) |

## ■ Permutation ($_nP_r$), Combination ($_nC_r$)

**•Total permutations**

$$_nP_r = \frac{n!}{(n-r)!}$$

**•Total combinations**

$$_nC_r = \frac{n!}{r!\,(n-r)!}$$

| Example | Operation | Display |
|---|---|---|
| Taking any four out of ten items and arranging them in a row, how many different arrangement are possible?<br>$_{10}P_4 = 5040$ | 10 [SHIFT] [nPr] 4 [EXE] | 5040. |
| How many even 4-digit numbers, in which no two digits are identical, can be formed using the numbers 1 through 7?<br>$_7P_4 \times \frac{3}{7} = 360$ | 7 [SHIFT] [nPr] 4 [×] 3 [÷] 7 [EXE] | 360. |
| If any four items are removed from 10 items, how many different combinations are possible?<br>$_{10}C_4 = 210$ | 10 [SHIFT] [nCr] 4 [EXE] | 210. |
| In a class of 15 boys and 10 girls, how many different combinations are possible if 5-member groups are formed, in which at least one member per group must be a girl?<br>$_{25}C_5 - {}_{15}C_5 = 50127$ | 25 [SHIFT] [nCr] 5 [−] 15 [SHIFT] [nCr] 5 [EXE] | 50127. |



## ■ Other Functions ($\sqrt{\ }$, $x^2$, $x^{-1}$, $x!$, $\sqrt[3]{\ }$, Ran#)

•The operations noted below are not possible in the BASE-N mode.

| Example | Operation | Display |
|---|---|---|
| $\sqrt{2}+\sqrt{5} = 3.65028154$ | [√] 2 [+] [√] 5 [EXE] | 3.65028154 |
| $2^2+3^2+4^2+5^2 = 54$ | 2 [SHIFT] [x²] [+] 3 [SHIFT] [x²] [+] 4 [SHIFT] [x²] [+] 5 [SHIFT] [x²] [EXE] | 54. |
| $\frac{1}{\frac{1}{3}-\frac{1}{4}} = 12$ | [(] 3 [x⁻¹] [−] 4 [x⁻¹] [)] [x⁻¹] [EXE] | 12. |
| $8!(=1\times2\times3\times\ldots\ldots\times8) = 40320$ | 8 [SHIFT] [x!] [EXE] | 40320. |
| $\sqrt[3]{36\times42\times49} = 42$ | [SHIFT] [∛] [(] 36 [×] 42 [×] 49 [)] [EXE] | 42. |
| Random number generation (pseudo-random number from 0.000 to 0.999) | [SHIFT] [Ran#] [EXE] | (Ex.) 0.792 |
| $\sqrt{13^2-5^2}+\sqrt{3^2+4^2} = 17$ | [√] [(] 13 [SHIFT] [x²] [−] 5 [SHIFT] [x²] [)] [+] [√] [(] 3 [SHIFT] [x²] [+] 4 [SHIFT] [x²] [)] [EXE] | 17. |
| $\sqrt{1-\sin^2 40°} = 0.7660444431$<br>$= \cos 40°$<br>(Proof of $\cos\theta = \sqrt{1-\sin^2\theta}$) | [MODE] [4] → "D"<br>[√] [(] 1 [−] [(] [sin] 40 [)] [SHIFT] [x²] [)] [EXE]<br>(Continuing) [SHIFT] [cos] [Ans] [EXE] | 0.7660444431<br>40. |
| $\frac{1}{2!}+\frac{1}{4!}+\frac{1}{6!}+\frac{1}{8!}$<br>$= 0.5430803571$ | 2 [SHIFT] [x!] [x⁻¹] [+] 4 [SHIFT] [x!] [x⁻¹] [+] 6 [SHIFT] [x!] [x⁻¹] [+] 8 [SHIFT] [x!] [x⁻¹] [EXE] | 0.5430803571 |

## ■ Performing Percent Calculations

| Example | Operation | Display |
|---|---|---|
| •**Percent**<br>To calculate 26% of 1,500. | 1500 × 26 SHIFT % | 390. |
| •**Add-on**<br>To calculate 3,620 increased by 15%. | 3620 × 15 SHIFT % + | 4163. |
| •**Discount**<br>To calculate 4,750 decreased by 4%. | 4750 × 4 SHIFT % − | 4560. |
| •**Ratio**<br>To calculate what percent of 250 is 75. | 75 ÷ 250 SHIFT % | 30.(%) |
| •**Increase / decrease**<br>To calculate what percent increase it is from \$120 to \$141. | 141 − 120 SHIFT % | 17.5(%) |
| To calculate what percent decrease it is from \$300 to \$240. | 240 − 300 SHIFT % | −20.(%) |



# 9/Performing Engineering Symbol Calculations

- Use the keys marked with ENG symbols to perform engineering symbol calculations.
- Use the key operation MODE . to enter the ENG mode (ENG symbol appears on the display). Press MODE . again to cancel the ENG mode.

| Operation | Unit | Symbol |
|---|---|---|
| SHIFT k (= 6) | $10^{3}$ | k (Kilo) |
| SHIFT M (= 7) | $10^{6}$ | M (Mega) |
| SHIFT G (= 8) | $10^{9}$ | G (Giga) |
| SHIFT T (= 9) | $10^{12}$ | T (Tera) |
| SHIFT m (= 5) | $10^{-3}$ | m (Milli) |
| SHIFT μ (= 4) | $10^{-6}$ | μ (Micro) |
| SHIFT n (= 3) | $10^{-9}$ | *n* (Nano) |
| SHIFT p (= 2) | $10^{-12}$ | p (Pico) |
| SHIFT f (= 1) | $10^{-15}$ | *f* (Femto) |

| Example | Operation | Display |
|---|---|---|
| | MODE . → "ENG" | |
| 999k (Kilo) + 25k (Kilo) = 1.024M (Mega) | 999 SHIFT k + 25 SHIFT k EXE | 1.024M |
| 100m (Milli) × 5μ (Micro) = 500n (Nano) | 100 SHIFT m × 5 SHIFT μ EXE | 500.n |
| 9 ÷ 10 = 0.9 = 900m (Milli) | 9 ÷ 10 EXE | 900.m |
| | SHIFT ENG | 0.9 |
| | SHIFT ENG | 900.m |

# 10/Performing Binary, Octal, Decimal and Hexadecimal Calculations

- You can perform binary, octal, decimal, and hexadecimal calculations and conversions in the BASE-N mode ([MODE] [1]). The BASE-N indicator is shown on the display in this mode.
- You can specify the default number system by pressing [BIN] for binary (BIN indicator shown on display), [OCT] for octal (OCT indicator), [DEC] for decimal (DEC indicator), and [HEX] for hexadecimal (HEX indicator).
- No matter what the default number system, you can specify the number system for a specific value by pressing [SHIFT] [b] for binary, [SHIFT] [o] for octal, [SHIFT] [d] for decimal or [SHIFT] [h] for hexadecimal before entering the value.
- You cannot specify the unit of angular measurement (degrees, radians, grads) or the display format (FIX, SCI) while the calculator is in the BASE-N mode. Such specifications can only be made if you first exit the BASE-N mode.
- You cannot use scientific functions in the BASE-N mode.
- Only integers can be used in the BASE-N mode, so you aren't able to enter any value that has a fraction or exponent. When a calculation produces a result with a fraction, the fractional part is cut off.
- Remember that each number system has a different range of values. If you try to enter values that are outside the range of the default number system, an error will occur unless you specify another number system for the value using the procedure described above.

| Number system | Values |
|---|---|
| Binary | 0, 1 |
| Octal | 0, 1, 2, 3, 4, 5, 6, 7 |
| Decimal | 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 |
| Hexadecimal | 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F |

- The values A through F in the hexadecimal system are represented as shown below to distinguish them from standard alphabetical characters.

| Key | Display |
|---|---|
| [A] ( = [x] ) | A |
| [B] ( = [(-)] ) | B |
| [C] ( = [hyp] ) | C |
| [D] ( = [sin] ) | D |
| [E] ( = [cos] ) | E |
| [F] ( = [tan] ) | F |



- Negatives for binary, octal, and hexadecimal are expressed using their two's complement.
- The following table shows the display limitations for calculation results in each number system.

| Number system | Display limitation |
|---|---|
| Binary | 32 digits (displayed as 4 blocks of 8 digits each) |
| Octal | 11 digits |
| Decimal | 10 digits |
| Hexadecimal | 8 digits |

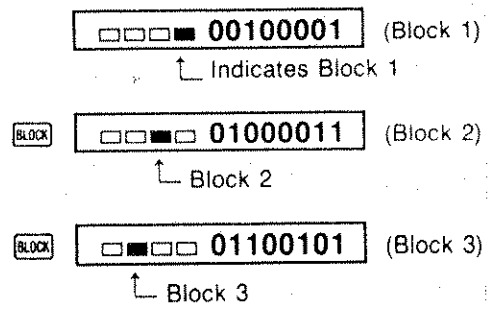
## ■ Block Display for Binary Values

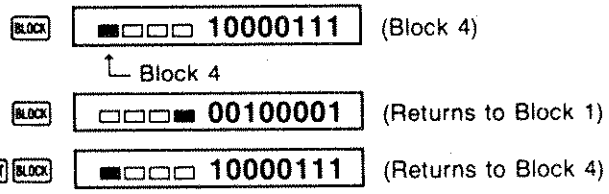
- Binary results are displayed up to 32 digits long, broken down into 4 blocks of 8 digits each.

**Example**

| Block 4 | Block 3 | Block 2 | Block 1 |
|---|---|---|---|
| 10000111 | 01100101 | 01000011 | 00100001 |
| ← 8 digits → | ← 8 digits → | ← 8 digits → | ← 8 digits → |
| ← 32 digits → | | | |

- Calculation results are always displayed starting with Block 1. Then, each time you press the [BLOCK] key, the display changes in the sequence Block 2→Block 3→Block 4, and then back to Block 1. You can tell which block is currently displayed by looking at the four boxes on the left end of the calculator's display.
When [BLOCK] is pressed following [SHIFT], the display changes in the following sequence:
→ Block 4 → Block 3 → Block 2 → Block 1 →






## ■ Performing Binary/Octal/Decimal/Hexadecimal Conversions

- There are two different methods that you can use to convert among binary, octal, decimal, and hexadecimal.

### •Conversion to the Default Mode

With this method, set the default number system to the system that you want the final result to be in, and then individually specify the number systems for the values you are inputting.

| Example | Operation | Display |
|---|---|---|
| | MODE 1 → "BASE-N" | |
| $2A_{16}$, $274_8$ conversion to decimal | DEC → "DEC" | |
| | SHIFT h 2A EXE | DEC 42 |
| | SHIFT o 274 EXE | DEC 188 |
| $123_{10}$, $1010_2$ conversion to hexadecimal | HEX → "HEX" | |
| | SHIFT d 123 EXE | HEX 0000007B |
| | SHIFT b 1010 EXE | HEX 0000000A |
| $15_{16}$, $1100_2$ conversion to octal | OCT → "OCT" | |
| | SHIFT h 15 EXE | OCT 00000000025 |
| | SHIFT b 1100 EXE | OCT 00000000014 |
| $36_{10}$, $2C_{16}$ conversion to binary | BIN → "BIN" | |
| | SHIFT d 36 EXE | BIN □□□■ 00100100 |
| | SHIFT h 2C EXE | BIN □□□■ 00101100 |



### •Final Result Conversion

With this method, you determine a final result and then press a number system key to change the result to another system.

| Example | Operation | Display |
|---|---|---|
| $22_{10}$ conversion to binary, octal, and hexadecimal | MODE 1 → "BASE-N" | |
| | DEC → "DEC" | |
| | 22 EXE | DEC 22 |
| | BIN | BIN □□□■ 00010110 |
| | OCT | OCT 00000000026 |
| | HEX | HEX 00000016 |

## ■ Expressing Negative Values

| Example | Operation | Display |
|---|---|---|
| | MODE 1 → "BASE-N" | |
| Negative of $110010_2$ | BIN → "BIN" | |
| | Neg 110010 EXE | BIN □□□■ 11001110 |
| | BLOCK | BIN □□■□ 11111111 |
| | BLOCK | BIN □■□□ 11111111 |
| | BLOCK | BIN ■□□□ 11111111 |
| Negative of $72_8$ | OCT → "OCT" | |
| | Neg 72 EXE | OCT 37777777706 |
| Negative of $3A_{16}$ | HEX → "HEX" | |
| | Neg 3A EXE | HEX FFFFFFC6 |

## ■ Performing Binary/Octal/Decimal/Hexadecimal Arithmetic Calculations

| Example | Operation | Display |
|---|---|---|
| | [MODE] [1] → "BASE-N" | |
| $10111_2 + 11010_2 = 110001_2$ | [BIN] → "BIN" | |
| | 10111 [+] 11010 [EXE] | BIN 00110001 |
| $B47_{16} - DF_{16} = A68_{16}$ | [HEX] → "HEX" | |
| | B47 [−] DF [EXE] | HEX 00000A68 |
| $123_8 \times ABC_{16} = 37AF4_{16}$ | [SHIFT] [o] 123 [×] ABC [EXE] | HEX 00037AF4 |
| $= 228084_{10}$ | [DEC] | DEC 228084 |
| $1F2D_{16} - 100_{10} = 7881_{10}$ | [SHIFT] [h] 1F2D [−] 100 [EXE] | DEC 7881 |
| $= 1EC9_{16}$ | [HEX] | HEX 00001EC9 |
| $7654_8 \div 12_{10} = 334.3333333_{10}$ | [DEC] → "DEC" | |
| $= 516_8$ | [SHIFT] [o] 7654 [÷] 12 [EXE] | DEC 334 |
| | [OCT] | OCT 00000000516 |
| *Fractional portions are cut off. | | |
| $1234_{10} + 1EF_{16} \div 24_8 = 2352_8$ | [SHIFT] [d] 1234 [+] [SHIFT] [h] 1EF [÷] 24 [EXE] | OCT 00000002352 |
| $= 1258_{10}$ | [DEC] | DEC 1258 |
| *Multiplication and division are given precedence over addition and subtraction in mixed calculations. | | |

## ■ Performing Logical Operations

The logical operations of your scientific calculator give you logical products (AND), logical sums (OR), negation (NOT), exclusive logical sums (XOR), and negation of exclusive logical sums (XNOR).



| Example | Operation | Display |
|---|---|---|
| | [MODE] [1] → "BASE-N" | |
| $19_{16}$ AND $1A_{16} = 18_{16}$ | [HEX] → "HEX" | |
| | 19 [SHIFT] [and] 1A [EXE] | HEX 00000018 |
| $1110_2$ AND $36_8 = 1110_2$ | [BIN] → "BIN" | |
| | 1110 [SHIFT] [and] [SHIFT] [o] 36 [EXE] | BIN 00001110 |
| $23_8$ OR $61_8 = 63_8$ | [OCT] → "OCT" | |
| | 23 [SHIFT] [or] 61 [EXE] | OCT 00000000063 |
| $120_{16}$ OR $1101_2 = 12D_{16}$ | [HEX] → "HEX" | |
| | 120 [SHIFT] [or] [SHIFT] [b] | |
| | 1101 [EXE] | HEX 0000012D |
| $1010_2$ AND ($A_{16}$ OR $7_{16}$) | [BIN] → "BIN" | |
| $= 1010_2$ | 1010 [SHIFT] [and] ( [SHIFT] [h] A | |
| | [SHIFT] [or] [SHIFT] [h] 7 ) [EXE] | BIN 00001010 |
| $5_{16}$ XOR $3_{16} = 6_{16}$ | [HEX] → "HEX" | |
| | 5 [SHIFT] [xor] 3 [EXE] | HEX 00000006 |
| $2A_{16}$ XNOR $5D_{16}$ | | |
| $= FFFFFF88_{16}$ | [HEX] → "HEX" | |
| | 2A [SHIFT] [xnor] 5D [EXE] | HEX FFFFFF88 |
| Negation of $1234_8$ | [OCT] → "OCT" | |
| | [Not] 1234 [EXE] | OCT 37777776543 |
| Negation of $2FFFED_{16}$ | [HEX] → "HEX" | |
| | [Not] 2FFFED [EXE] | HEX FFD00012 |

# 11/Performing Statistical Calculations

For statistics, you have a choice of the SD mode for standard deviation calculations, and the LR mode for regression calculations.

## ■ Performing Standard Deviation Calculations

•In the SD mode (MODE 3), you can calculate paired two types of standard deviation, mean, number of data, the sum of data, the sum of squares of data.

### •Data Input

① Press MODE 3 to enter the SD mode.
② Press SHIFT KAC to clear the statistical memories.
③ Enter each data item, using the following sequence: DATA DT.

**Example**

Data: 10, 20, 30
Procedure: 10 DT 20 DT 30 DT

*You can enter identical data items by pressing the DT key repeatedly, or by specifying the number of data that are the same.

**Example 1**

Data: 10, 20, 20, 30
Procedure: 10 DT 20 DT DT 30 DT

Each time you press DT without entering a new data item, the previously entered data item (here, 20) is entered again.

**Example 2**

Data: 10, 20, 20, 20, 20, 20, 20, 30
Procedure: 10 DT 20 SHIFT : 6 DT 30 DT

The value which you entered after the semicolon (here, 6) tells the calculator how many times to repeat the previously entered data item (here, 20).

### •Deleting Entered Data

**Example 1**

40 DT 20 DT 30 DT 50 DT
To delete 50 DT: SHIFT CL

**Example 2**

40 DT 20 DT 30 DT 50 DT
To delete 20 DT: 20 SHIFT CL

**Example 3**

30 DT 50 DT 120 SHIFT :
To clear 120 SHIFT : AC



**Example 4**

30 DT 50 DT 120 SHIFT : 31
To clear 120 SHIFT : 31: AC

**Example 5**

30 DT 50 DT 120 SHIFT : 31 DT
To clear 120 SHIFT : 31 DT: SHIFT CL

**Example 6**

50 DT 120 SHIFT : 31 DT 40 DT 30 DT
To clear 120 SHIFT : 31 DT: 120 SHIFT : 31 SHIFT CL

### •Calculations

The following table shows the results produced by each key operation:

| Key Operation | Result | |
|---|---|---|
| SHIFT $x\sigma_n$ EXE | Population standard deviation $x\sigma_n$ | $x\sigma_n$ = 2 |
| SHIFT $x\sigma_{n-1}$ EXE | Sample standard deviation $x\sigma_{n-1}$ | $x\sigma_{n-1}$ = 3 |
| SHIFT $\bar{x}$ EXE | Mean | $\bar{x}$ = 1 |
| IK $\Sigma x^2$ EXE | Sum of squares of data | $\Sigma x^2$ = 1 |
| IK $\Sigma x$ EXE | Sum of data | $\Sigma x$ = 2 |
| IK $n$ EXE | Number of data items | $n$ = 3 |

### •The following formulas are used for standard deviation:

$$\sigma_n = \sqrt{\frac{\sum_{i=1}^{n}(x_i-\bar{x})^2}{n}} = \sqrt{\frac{\Sigma x^2-(\Sigma x)^2/n}{n}}$$

(For calculation of population standard deviation using all data for a finite population.)

$$\sigma_{n-1} = \sqrt{\frac{\sum_{i=1}^{n}(x_i-\bar{x})^2}{n-1}} = \sqrt{\frac{\Sigma x^2-(\Sigma x)^2/n}{n-1}}$$

(For estimation of sample standard deviation for an entire population using a sample from the population.)

### •Mean formula

$$\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n} = \frac{\Sigma x}{n}$$

| Example | Operation | Display |
|---|---|---|
| Data: 55, 54, 51, 55, 53, 53, 54, 52 | MODE 3 → "SD"<br>(Memory clear) SHIFT KAC<br>55 DT 54 DT 51 DT 55 DT 53<br>DT DT 54 DT 52 DT | 52. |
| *The same results can be obtained no matter in what sequence they are recalled. | | |
| | (Population standard deviation $\sigma n$) SHIFT $x\sigma_n$ EXE | 1.316956719 |
| | (Sample standard deviation $\sigma n-1$) SHIFT $x\sigma_{n-1}$ EXE | 1.407885953 |
| | (Mean $x$) SHIFT $\bar{x}$ EXE | 53.375 |
| | (Number of data $n$) IK $n$ EXE | 8. |
| | (Sum $\Sigma x$) IK $\Sigma x$ EXE | 427. |
| | (Sum of squares $\Sigma x^2$) IK $\Sigma x^2$ EXE | 22805. |
| Deviation of unbiased variance, difference between each datum, and mean of above data | (Continuing) SHIFT $x\sigma_{n-1}$ SHIFT $x^2$ EXE | 1.982142857 |
| | 55 ▪ SHIFT $\bar{x}$ EXE | 1.625 |
| | 54 ▪ SHIFT $\bar{x}$ EXE | 0.625 |
| | 51 ▪ SHIFT $\bar{x}$ EXE | −2.375 |
| | ⋮ | ⋮ |
| To calculate $\bar{x}$ and $\sigma_{n-1}$ for the following table. | SHIFT KAC | |
| | 110 SHIFT : 10 DT | 110. |
| | 130 SHIFT : 31 DT | 130. |
| | 150 SHIFT : 24 DT | 150. |
| | 170 DT DT | 170. |
| | 190 DT DT DT | 190. |
| | IK $n$ EXE | 70. |
| | SHIFT $\bar{x}$ EXE | 137.7142857 |
| | SHIFT $x\sigma_{n-1}$ EXE | 18.42898069 |

| Rank | Value | Frequency |
|---|---|---|
| 1 | 110 | 10 |
| 2 | 130 | 31 |
| 3 | 150 | 24 |
| 4 | 170 | 2 |
| 5 | 190 | 3 |



## ■ Performing Regression Calculations

•In the LR mode (MODE 2), you can perform linear, logarithmic, exponential and power regression calculations.

### ⟨Linear Regression⟩

Linear regression is performed by the calculator using the formula $y = A + Bx$.

### •Data Input

① Press MODE 2 to enter the LR mode.
② Press SHIFT KAC to clear the statistical memories.
③ Enter each data item, using the following sequence:
⟨X-DATA⟩ SHIFT • ⟨Y-DATA⟩ DT

*You can enter identical data items by pressing the DT key repeatedly, or by specifying the number of data pairs that are the same.

**Example 1**

Data: 10/20, 20/30, 20/30, 40/50
Procedure: 10 SHIFT • 20 DT
20 SHIFT • 30 DT DT
40 SHIFT • 50 DT

Each time you press DT without entering a new data pair, the previously entered data pair (here, 20/30) is entered again.

**Example 2**

Data: 10/20, 20/30, 20/30, 20/30, 20/30, 20/30, 40/50
Procedure: 10 SHIFT • 20 DT
20 SHIFT • 30 SHIFT : 5 DT
40 SHIFT • 50 DT

The value which you entered after the semicolon (here, 5) tells the calculator how many times to repeat the previously entered data pair (here, 20/30).

### •Deleting Entered Data

**Example 1**

10 SHIFT • 40 DT
20 SHIFT • 20 DT
30 SHIFT • 30 DT
40 SHIFT • 50

To delete 40 SHIFT • 50: AC

**Example 2**

10 [SHIFT] [,] 40 [DT]
20 [SHIFT] [,] 20 [DT]
30 [SHIFT] [,] 30 [DT]
40 [SHIFT] [,] 50 [DT]

To delete 40 [SHIFT] [,] 50 [DT]: [SHIFT] [CL]

**Example 3**

10 [SHIFT] [,] 40 [DT]
20 [SHIFT] [,] 20 [DT]
30 [SHIFT] [,] 30 [DT]
40 [SHIFT] [,] 50 [DT]

To delete 20 [SHIFT] [,] 20 [DT]: 20 [SHIFT] [,] 20 [SHIFT] [CL]

## •Calculations

The following table shows the results produced by each key operation:

| Key Operation | Result |
|---|---|
| [SHIFT] [A] [EXE] | Constant term A |
| [SHIFT] [B] [EXE] | Regression coefficient B |
| [SHIFT] [r] [EXE] | Correlation coefficient $r$ |
| [SHIFT] [$\hat{x}$] [EXE] | Estimated value of $x$ |
| [SHIFT] [$\hat{y}$] [EXE] | Estimated value of $y$ |

[A] = [7]
[B] = [8]
[r] = [9]
[$\hat{x}$] = [×]
[$\hat{y}$] = [÷]

### •Regression Formulas

The following formulas are used for constant term A, regression coefficient B and correlation coefficient $r$:

$$A = \frac{\Sigma y - B \cdot \Sigma x}{n} \qquad B = \frac{n \cdot \Sigma xy - \Sigma x \cdot \Sigma y}{n \cdot \Sigma x^2 - (\Sigma x)^2}$$

$$r = \frac{n \cdot \Sigma xy - \Sigma x \cdot \Sigma y}{\sqrt{\{n \cdot \Sigma x^2 - (\Sigma x)^2\}\{n \cdot \Sigma y^2 - (\Sigma y)^2\}}}$$



| Example | Operation | Display |
|---|---|---|
| •Length of a steel rod at various temperatures | [MODE] [2] → "LR" | |
| | (Memory clear) [SHIFT] [KAC] | |
| | **10** [SHIFT] [,] **1003** [DT] | 10. |
| | **15** [SHIFT] [,] **1005** [DT] | 15. |
| | **20** [SHIFT] [,] **1010** [DT] | 20. |
| | **25** [SHIFT] [,] **1011** [DT] | 25. |
| | **30** [SHIFT] [,] **1014** [DT] | 30. |
| | (Constant term A) [SHIFT] [A] [EXE] | 997.4 |
| | (Regression coefficient B) [SHIFT] [B] [EXE] | 0.56 |
| | (Correlation coefficient $r$) [SHIFT] [r] [EXE] | 0.9826073689 |
| | (Length at 18°C) **18** [SHIFT] [$\hat{y}$] [EXE] | 1007.48 |
| | (Temperature for 1,000mm length) **1000** [SHIFT] [$\hat{x}$] [EXE] | 4.642857143 |
| | (Critical coefficient) [SHIFT] [r] [SHIFT] [$x^2$] [EXE] | 0.9655172414 |
| | (Covariance) [(] [IK] [$\Sigma xy$] [−] [IK] [$n$] [×] [SHIFT] [$\hat{x}$] [×] [SHIFT] [$\hat{y}$] [)] [÷] [(] [IK] [$n$] [−] **1** [)] [EXE] | 35. |

Constant term A: $\frac{\Sigma y - B \cdot \Sigma x}{n}$.

Regression coefficient B: $\left(\frac{\Sigma xy - n \cdot \bar{x} \cdot \bar{y}}{n-1}\right)$.

## ⟨Logarithmic Regression⟩

•The calculator uses the formula $y = A + B \cdot \ln x$ for logarithmic regression.

### •Data Input

① Press [MODE] [2] to enter the LR mode.
② Press [SHIFT] [KAC] to clear the statistical memories.
③ Enter each data item, using the following sequence:
[ln] ⟨X-DATA⟩ [SHIFT] [,] ⟨Y-DATA⟩ [DT].

*You can enter identical data items using the same two procedures described for linear regression, but you must always press the [ln] key before entering the X-DATA.

### •Deleting Entered Data

To delete entered data, use the same procedures described for linear regression, but remember to always press the [ln] key before entering X-DATA.

### •Calculations

The following table shows the results produced by each key operation:

| Key Operation | Result | |
|---|---|---|
| [SHIFT] [A] [EXE] | Constant term A | [A] = [7] |
| [SHIFT] [B] [EXE] | Regression coefficient B | [B] = [8] |
| [SHIFT] [r] [EXE] | Correlation coefficient $r$ | [r] = [9] |
| $y$ [SHIFT] [$\hat{x}$] [EXE] [SHIFT] [$e^x$] [Ans] [EXE] | Estimated value of $x$ | [$\hat{x}$] = [×] |
| [ln] $x$ [SHIFT] [$\hat{y}$] [EXE] | Estimated value of $y$ | [$\hat{y}$] = [÷] |

If we assume that $\ln x = x$, the logarithmic regression formula $y = A + B \cdot \ln x$ becomes the linear regression formula $y = a + bx$. Therefore, the formulas for constant term A, regression coefficient B and correlation coefficient $r$ are identical for logarithmic and linear regression.

A number of logarithmic regression calculation results differ from those produced by linear regression. Note the following:

| Linear regression | Logarithmic regression |
|---|---|
| $\Sigma x$ | $\Sigma \ln x$ |
| $\Sigma x^2$ | $\Sigma (\ln x)^2$ |
| $\Sigma xy$ | $\Sigma \ln x \cdot y$ |



| Example | Operation | Display |
|---|---|---|
| | [MODE] [2] → "LR" | |
| | [SHIFT] [KAC] | |
| | [ln] 29 [SHIFT] [,] 1.6 [DT] | 3.36729583 |
| | [ln] 50 [SHIFT] [,] 23.5 [DT] | 3.912023005 |
| | [ln] 74 [SHIFT] [,] 38.0 [DT] | 4.304065093 |
| | [ln] 103 [SHIFT] [,] 46.4 [DT] | 4.634728988 |
| | [ln] 118 [SHIFT] [,] 48.9 [DT] | 4.770684624 |
| To perform logarithmic regression on the above data to determine the regression formula and the correlation coefficient. Then use the regression formula to estimate $\hat{y}$ when $xi = 80$ and $\hat{x}$ when $yi = 73$. | (Constant term A) [SHIFT] [A] [EXE] | −111.1283976 |
| | (Regression coefficient B) [SHIFT] [B] [EXE] | 34.02014748 |
| | (Correlation coefficient $r$) [SHIFT] [r] [EXE] | 0.9940139464 |
| | ($\hat{y}$ when $xi = 80$) [ln] 80 [SHIFT] [$\hat{y}$] [EXE] | 37.94879482 |
| | ($\hat{x}$ when $yi = 73$) 73 [SHIFT] [$\hat{x}$] [EXE] [SHIFT] [$e^x$] [Ans] [EXE] | 224.1541314 |

| $xi$ | $yi$ |
|---|---|
| 29 | 1.6 |
| 50 | 23.5 |
| 74 | 38.0 |
| 103 | 46.4 |
| 118 | 48.9 |

## 〈Exponential Regression〉

•The calculator uses the formula $y = A \cdot e^{B \cdot x}$ ($\ln y = \ln A + Bx$) for exponential regression.

### •Data Input

① Press [MODE] [2] to enter the LR mode.
② Press [SHIFT] [KAC] to clear the statistical memories.
③ Enter each data item, using the following sequence:
〈X-DATA〉 [SHIFT] [,] [ln] 〈Y-DATA〉 [DT].

*You can enter identical data items using the same two procedures described for linear regression, but you must always press the [ln] key before entering the Y-DATA.

### •Deleting Entered Data

To delete entered data, use the same procedures described for linear regression, but remember to always press the [ln] key before entering Y-DATA.

### •Calculations

The following table shows the results produced by each key operation:

| Key Operation | Result |
|---|---|
| [SHIFT] [$e^x$] [SHIFT] [A] [EXE] | Constant term A |
| [SHIFT] [B] [EXE] | Regression coefficient B |
| [SHIFT] [r] [EXE] | Correlation coefficient $r$ |
| [ln] $y$ [SHIFT] [$\hat{x}$] [EXE] | Estimated value of $x$ |
| $x$ [SHIFT] [$\hat{y}$] [EXE] [SHIFT] [$e^x$] [Ans] [EXE] | Estimated value of $y$ |

[A] = [7]
[B] = [8]
[r] = [9]
[$\hat{x}$] = [×]
[$\hat{y}$] = [−]

If we assume that $\ln y = y$ and $\ln A = a'$, the exponential regression formula $y = A \cdot e^{B \cdot x}$ ($\ln y = \ln A + Bx$) becomes the linear regression formula $y = a + bx$. Therefore, the formulas for constant term A, regression coefficient B and correlation coefficient $r$ are identical for exponential and linear regression.

A number of exponential regression calculation results differ from those produced by linear regression. Note the following:

| Linear regression | Exponential regression |
|---|---|
| $\Sigma y$ | $\Sigma \ln y$ |
| $\Sigma y^2$ | $\Sigma (\ln y)^2$ |
| $\Sigma xy$ | $\Sigma x \cdot \ln y$ |



| Example | Operation | Display |
|---|---|---|
| | [MODE] [2] → "LR" | |
| | [SHIFT] [KAC] | |
| $xi$ 6.9 / $yi$ 21.4 | **6.9** [SHIFT] [,] [ln] **21.4** [DT] | **6.9** |
| 12.9 / 15.7 | **12.9** [SHIFT] [,] [ln] **15.7** [DT] | **12.9** |
| 19.8 / 12.1 | **19.8** [SHIFT] [,] [ln] **12.1** [DT] | **19.8** |
| 26.7 / 8.5 | **26.7** [SHIFT] [,] [ln] **8.5** [DT] | **26.7** |
| 35.1 / 5.2 | **35.1** [SHIFT] [,] [ln] **5.2** [DT] | **35.1** |
| | (Constant term A) | |
| | [SHIFT] [$e^x$] [SHIFT] [A] [EXE] | **30.49758742** |
| | (Regression coefficient B) | |
| | [SHIFT] [B] [EXE] | **−0.0492037083** |
| | (Correlation coefficient $r$) | |
| | [SHIFT] [r] [EXE] | **−0.9972473517** |
| To perform exponential regression on the above data to determine the regression formula and the correlation coefficient. Then use the regression formula to estimate $\hat{y}$ when $xi = 16$ and $\hat{x}$ when $yi = 20$. | ($\hat{y}$ when $xi = 16$) | |
| | **16** [SHIFT] [$\hat{y}$] [EXE] [SHIFT] [$e^x$] [Ans] [EXE] | **13.87915739** |
| | ($\hat{x}$ when $yi = 20$) | |
| | [ln] **20** [SHIFT] [$\hat{x}$] [EXE] | **8.574868045** |

## 〈Power Regression〉

•The calculator uses the formula $y = A \cdot x^B$ ($\ln y = \ln A + B \ln x$) for power regression.

### •Data Input

① Press [MODE] [2] to enter the LR mode.
② Press [SHIFT] [KAC] to clear the statistical memories.
③ Enter each data item, using the following sequence:
[ln] 〈X-DATA〉 [SHIFT] [·] [ln] 〈Y-DATA〉 [DT].

*You can enter identical data items using the same two procedures described for linear regression, but you must always press the [ln] key before entering both X-DATA and Y-DATA.

### •Deleting Entered Data

To delete entered data, use the same procedures described for linear regression, but remember to always press the [ln] key before entering X-DATA and Y-DATA.

### •Calculations

The following table shows the results produced by each key operation:

| Key Operation | Result | |
|---|---|---|
| [SHIFT] [$e^x$] [SHIFT] [A] [EXE] | Constant term A | [A] = [7] |
| [SHIFT] [B] [EXE] | Regression coefficient B | [B] = [8] |
| [SHIFT] [r] [EXE] | Correlation coefficient $r$ | [r] = [9] |
| [ln] $y$ [SHIFT] [$\hat{x}$] [EXE] [SHIFT] [$e^x$] [Ans] [EXE] | Estimated value of $x$ | [$\hat{x}$] = [×] |
| [ln] $x$ [SHIFT] [$\hat{y}$] [EXE] [SHIFT] [$e^x$] [Ans] [EXE] | Estimated value of $y$ | [$\hat{y}$] = [÷] |

If we assume that $\ln y = y$, $\ln A = a'$ and $\ln x = x$, the power regression formula $y = A \cdot x^B$ ($\ln y = \ln A + B \ln x$) becomes the linear regression formula $y = a + bx$. Therefore, the formulas for constant term A, regression coefficient B and correlation coefficient $r$ are identical for power and linear regression.

A number of power regression calculation results differ from those produced by linear regression. Note the following:

| Linear regression | Power regression |
|---|---|
| $\Sigma x$ | $\Sigma \ln x$ |
| $\Sigma x^2$ | $\Sigma (\ln x)^2$ |
| $\Sigma y$ | $\Sigma \ln y$ |
| $\Sigma y^2$ | $\Sigma (\ln y)^2$ |
| $\Sigma xy$ | $\Sigma \ln x \cdot \ln y$ |



| Example | Operation | Display |
|---|---|---|
| | [MODE] [2] → "LR" | |
| | [SHIFT] [KAC] | |
| $xi$ 28, $yi$ 2410 | [ln] 28 [SHIFT] [·] [ln] 2410 [DT] | 3.33220451 |
| $xi$ 30, $yi$ 3033 | [ln] 30 [SHIFT] [·] [ln] 3033 [DT] | 3.401197382 |
| $xi$ 33, $yi$ 3895 | [ln] 33 [SHIFT] [·] [ln] 3895 [DT] | 3.496507561 |
| $xi$ 35, $yi$ 4491 | [ln] 35 [SHIFT] [·] [ln] 4491 [DT] | 3.555348061 |
| $xi$ 38, $yi$ 5717 | [ln] 38 [SHIFT] [·] [ln] 5717 [DT] | 3.63758616 |
| | (Constant term A) | |
| | [SHIFT] [$e^x$] [SHIFT] [A] [EXE] | 0.2388010963 |
| | (Regression coefficient B) | |
| | [SHIFT] [B] [EXE] | 2.771866138 |
| | (Correlation coefficient $r$) | |
| | [SHIFT] [r] [EXE] | 0.9989062545 |
| To perform power regression on the above data to determine the regression formula and the correlation coefficient. Then use the regression formula to estimate $\hat{y}$ when $xi = 40$ and $\hat{x}$ when $yi = 1000$. | ($\hat{y}$ when $xi = 40$) | |
| | [ln] 40 [SHIFT] [$\hat{y}$] [EXE] [SHIFT] [$e^x$] [Ans] [EXE] | 6587.674882 |
| | ($\hat{x}$ when $yi = 1000$) | |
| | [ln] 1000 [SHIFT] [$\hat{x}$] [EXE] [SHIFT] [$e^x$] | |
| | [Ans] [EXE] | 20.26225639 |

# 12/Using Variables in Calculations

- A total of 26 variables are available. Each variable has a name, represented by the 26 letters of the alphabet from A through Z.
- Though there are 26 variables available, you can only use eight in any single calculation. Even if you connect a number of formulas together into a multistatement (see page 28), you are only allowed eight variables. If you try to use more than eight, you will get a Mem ERROR (memory error) message.
- When you execute a formula that contains variables, the calculator will ask you to input values for the variables whenever the calculation is executed.

**Example** Enter and execute $X = (A + B) \div 2$

Enter the formula.
[SHIFT] [ALPHA] [X] [=] [ALPHA] [(] [ALPHA] [A] [+] [ALPHA] [B] [)] [÷] 2

```
X=(A+B)÷2_
```

Execute the formula.
[EXE]

```
A?
```

Enter values for the variables.
7 [EXE]

```
B?
```

8 [EXE]

```
X=
```

(After approx. 0.5 seconds)

```
7.5
```

Execute the formula again.
[EXE]

```
A?
```

Enter different values.
10 [EXE] 20 [EXE]

```
X=
```

(After approx. 0.5 seconds)

```
15.
```



After you execute a formula once, the variable keeps the same value unless you enter another one. In the example above, we first assigned a value of 7 to variable A. If we wanted to keep the 7 the second time we executed the same calculation, we could have simply pressed [EXE] when the calculator asked for input of a value for A, because A was already assigned 7 the first time around. Note, however, that all variables are cleared when you press the [AC] key or when you switch the power of the calculator off.

- You can omit the "X =" when inputting the formula used in the example. If you do, the display "X =" will not appear before the result of the formula.

If you press [SHIFT] followed by [Var. Name], the calculator will display the name of the variable that has been assigned the displayed value, as long as you hold down the [Var. Name] key.

(Using the previous formula)

[EXE]

```
A?
```

Enter a value for Variable A.
8

```
8_
```

Confirm the variable name.
[SHIFT] [Var. Name] (While [Var. Name] is held down.)

```
A?
```

(Release [Var. Name].)

```
8_
```

Continue with the execution.
[EXE] 9 [EXE]

```
8.5
```

Confirm the variable name.
[SHIFT] [Var. Name] (While [Var. Name] is held down.)

```
X=
```

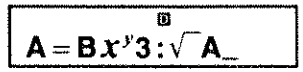
(Release [Var. Name].)

```
8.5
```

You can connect multiple formulas that contain variables into a multistatement (see page 28).

**Example** Enter and execute two formulas with variables.

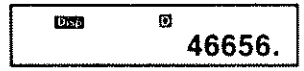
Enter the formulas.
SHIFT ALPHA A = B ALPHA $x^y$ 3 ALPHA : $\sqrt{}$ ALPHA A



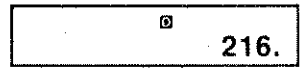

Execute the first formula.
EXE

Enter values for the variables.
36 EXE

(After approx. 0.5 seconds)




Execute the next formula.
EXE



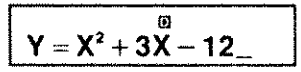

## 13/Using the Formula Storage Function

Your calculator is capable of storage of one formula, up to 63 steps long. The formula itself, as well as its mode (COMP, BASE-N, LR, SD) are stored, so any time you need it, you simply go to the proper mode, recall the formula, and press EXE to execute it. The following keys are used with the formula storage function.

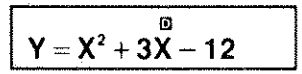
SHIFT IN — Stores displayed formula
OUT — Recalls stored formula

**Example** Store the following formula, and execute it.
$Y = X^2 + 3X - 12$

Enter the formula.
SHIFT ALPHA Y = X ALPHA SHIFT $x^2$ + 3 ALPHA X
− 12



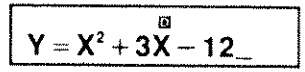

Store the formula.
SHIFT IN






Clear the calculator.
AC

Recall the formula.
OUT




Execute the formula.
EXE

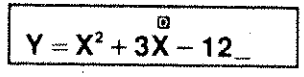
Assign values to the variables.
7 EXE

(After approx. 0.5 seconds)

After you recall a formula from memory, you can edit it as you wish.

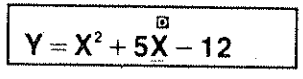
**Example** Edit the stored formula to $Y = X^2 + 5X - 12$.

Recall the formula.
OUT

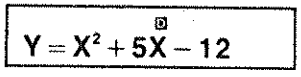



Move the cursor to the location of the change.
◀ ◀ ◀ ◀ ◀

Make the change.
5




Store the new formula (if you wish).
SHIFT IN



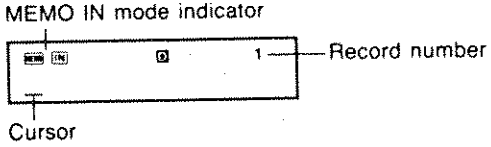

•To clear the contents of the formula memory, press AC SHIFT IN.

# 14/Using the Memo Function

The MEMO function of the fx-4200P acts as an electronic notebook to let you store formulas, constants, or other data for quick and easy recall when you need them. You can store data in memory while the calculator is in the MEMO IN mode. When you store data, the calculation mode (COMP, BASE-N, LR, SD) that the calculator is currently in is also stored in memory.

## ■ Entering the MEMO IN Mode

Press [MODE] [EXP] to enter the MEMO IN mode. At this time, the display should appear as illustrated below.



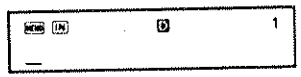

The [MEMO] [IN] indicator in the upper left of the display tells you that the calculator is currently in the MEMO IN mode. The value in the upper right of the display is called the ***Record Number,*** and it indicates which record is currently displayed.
The display illustrated above shows that there is nothing stored yet under the MEMO function, since the calculator is waiting for input at Record Number 1. If the Record Number was 5, for example, it would mean that the calculator is waiting for input at Record Number 5, so there are already four records stored under the MEMO function.
*You can exit the MEMO IN mode at any time by pressing [MODE] [EXP].

## ■ Entering Data

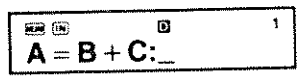
① Enter the MEMO IN mode ([MEMO] [IN] displayed).
② Enter the data.
③ Press the [EXE] key to store the data under the currently displayed Record Number. At this time, the cursor will disappear from the display.
*Enter a colon at the end of each data.

**Example** To store the formula A = B + C:

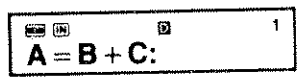
Enter the MEMO IN mode
[MODE] [EXP]




Enter the data.
[ALPHA] [A] [ALPHA] [=] [ALPHA] [B] [+] [ALPHA] [C] [ALPHA] [:]




Store the data.
[EXE]




With the above procedure, the formula A = B + C: is stored under Record Number 1.

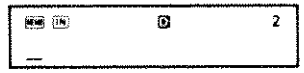


Now, if you press [EXE] again, the display will clear, the Record Number will advance to 2, and the cursor will reappear at the left side of the display to await further input.

**Example** To store the formula A = D × E:

Record number changed to 2.

Continuing from above.
[EXE]



Enter the data.
[ALPHA] [A] [ALPHA] [=] [ALPHA] [D] [×] [ALPHA] [E] [ALPHA] [:]

Store the data.
[EXE]

*With the above procedure, the formula A = D × E: is stored under Record Number 2.
*Keys that immediately execute their function when pressed cannot be entered as data in the MEMO IN mode. Such keys include: [%], [M+], [ENG], [DT], etc.

## ■ Editing Records

① Enter the MEMO IN mode.
② Locate the record to be edited and then press one of the cursor keys ([◁] or [▷]). At this time the [EDIT] symbol will appear on the display along with the cursor.
③ Use the cursor keys to move the cursor to the location of the change and enter the desired data.
④ Press the [EXE] key to store the edited record.

**Example** To change A = D × E: to A = D × E + 10:.

Indicates that two records are already stored.

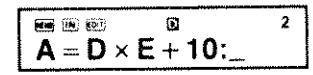
Enter the MEMO IN mode.
[MODE] [EXP]

Locate the record to be changed.
[MEMO] [MEMO]

[EDIT] indicator

Press one of the cursor keys.
[◁]

Edit the record.
[◁] [+] 10 [ALPHA] [:]




Press [EXE].
[EXE]

## ■ Inserting Records

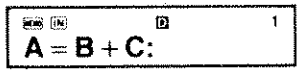
You can also insert a new record between two records that have already been stored in memory.

① Enter the MEMO IN mode.
② Locate the Record Number that immediately precedes the position where you wish the new record to be located (i.e. to insert at Record Number 3, first display Record Number 2).
③ Enter the record to be inserted.
④ Press the [EXE] key.

**Example** To insert the formula A = F − G: between Record Numbers 1 and 2.

Enter the MEMO IN mode.
[MODE] [EXP]

Locate the Record Number that immediately precedes the position where you wish to insert a new record (here, Record Number 1).
[MEMO]




Enter the data for the new record and press [EXE].

[ALPHA] [A] [ALPHA] [=] [ALPHA] [F] [−] [ALPHA] [G] [ALPHA] [:] [EXE]

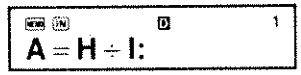
To insert a record at the Record Number 1 position, first enter the MEMO IN mode, display the existing Record Number 1 and then press [SHIFT] [EXE].

**Example** To insert A = H ÷ I: at Record Number 1.

Enter the MEMO IN mode and display the existing Record Number 1.
Next, proceed as follows:
[MEMO] [MEMO] [MEMO]

Press [SHIFT] [EXE].
[SHIFT] [EXE]

Enter the new Record Number 1 data.
[ALPHA] [A] [ALPHA] [=] [ALPHA] [H] [÷] [ALPHA] [I] [ALPHA] [:] [EXE]






## ■ Deleting Records

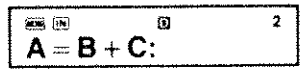
You can delete either single record or all records stored at once.

### •Deleting Single Record

① Enter the MEMO IN mode.
② Recall the record to be deleted.
③ Press one of the cursor keys ([⇦] or [⇨]), and confirm that the [EDIT] indicator appears on the display.
④ Press the [AC] key.
⑤ Press the [EXE] key.

**Example** To delete Record Number 2 (A = B + C:).

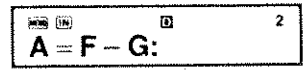
Enter the MEMO IN mode and locate the record to be deleted.




Press one of the cursor key.
[⇦]

Press the [AC] key.
[AC]

Press the [EXE] key.
[EXE]




Once the above operation is complete, the calculator automatically renumbers the remaining records to fill in the space created by the deletion.

### •Deleting All Records

① Enter the MEMO IN mode.
② Press [SHIFT] [AC]. At this time the message MEMO RESET? will appear on the display.
③ Press the [EXE] to confirm that you wish to delete all of the records stored. The display will clear and then change to Record Number 1.

Enter the MEMO IN mode and press [SHIFT] [AC].
[SHIFT] [AC]

[EXE]

*Pressing any key besides [EXE] when the message "MEMO RESET?" is displayed cancels the delete operation.

## ■ Searching for Data

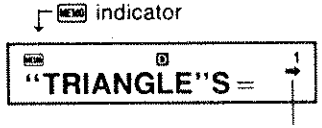
There are two methods that you can use to search for data stored in memory, ***Sequential Search*** and ***Initial Search***. Note that you should first cancel the MEMO IN mode. To exit the MEMO IN mode, press [MEMO] [EXP].
The examples used in this section will assume that the following data are stored in memory.

| Record Number | Data |
|---|---|
| 1 | "TRIANGLE" S = A × B ÷ 2: |
| 2 | "SQUARE" S = A × B: |
| 3 | "CIRCLE" S = πR²: |
| 4 | "TRAPEZOID" S = 2⁻¹ (A + B) H: |

### •Using Sequential Search

With sequential search, simply press the [MEMO] key to scroll through the records in ***sequential*** order.

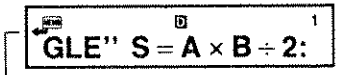
[MEMO]




Indicates that the record continues off the right side of the display.

You can use the cursor key to scroll through a record and see its entire contents.

[⇨][⇨][⇨][⇨][⇨][⇨]



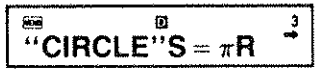

Indicates that the record continues off the left side of the display.

*You can move the display back to the left by pressing the [⇦] cursor key.
*The display will scroll at high speed if you hold the cursor keys down.

Continuing from the above...

[MEMO]

[MEMO]




[MEMO]

[MEMO]

If you press the [MEMO] key while the final record is displayed, the [MEMO] indicator will disappear and the display will clear.



*You can also use the [EXE] key to scroll through the records after the first record is displayed by pressing the [MEMO] key. However, the display will not change if you press the [EXE] key while the final record is displayed.

You can also scroll backwards through the record numbers by pressing [SHIFT] [EXE].

**Example** While Record Number 3 is displayed.

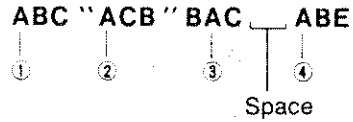
[SHIFT] [EXE]

*The display will not change if you press [SHIFT] [EXE] while Record Number 1 is displayed.

### •Using Initial Search

With initial search, you enter characters (up to eight steps) and press the [MEMO] key. The calculator will then recall any records in which the characters are included as ***initial*** characters of:
① The record itself
② A group of characters following a double quotation mark
③ A group of characters preceded by a space ([ALPHA] [SPACE]).

**Example** Note the following record:




If you enter A and press [MEMO] for initial search, the calculator would recall ① (initial character of record), ② (initial character of group preceded by a double quote), and ④ (initial character of group preceded by a space). ③ would not be recalled because it does not satisfy any of the conditions listed above.

**Example** To search for "CIRCLE" S = πR²: (page 63).

[ALPHA] C [MEMO]

[MEMO]

In this case, there is only one record that satisfies the initial search condition, so the [MEMO] indicator will disappear and the display clears when the [MEMO] key is pressed again. If there was another record that satisfied the condition, it would appear next when [MEMO] is pressed.

## ■ Executing Formulas Stored under the MEMO Function

You can store formulas under the MEMO function, and then use the formula memory to execute them whenever necessary. Simply recall the desired formula, store it in the formula memory, and then execute it.

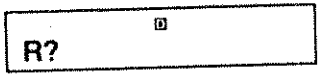
**Example** To recall "CIRCLE" $S = \pi R^2$: (page 63) and execute it for $R = 6$.

[MEMO] [MEMO] [MEMO]

[SHIFT] [1N]

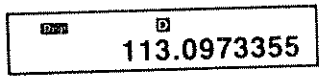
Formula is stored when the [MEMO] indicator disappears from the display.

[EXE]




Enter value for R.
6 [EXE]

Result




*Characters enclosed in double quotation marks are ignored by the calculator during formula execution.
*The [DISP] symbol appears on the display when the final result is displayed. This is because the formula executed contains a colon at the end. Press the [EXE] key again to complete execution.

## ■ Data Storage Capacity

The total storage capacity of the MEMO IN mode is 279 steps (see page 17 for information on steps). Exceeding this limitation will cause a Mem ERROR. The maximum capacity for each record is 63 steps. Theoretically, there is no limitation on the number of records that can be stored, as long as the 279-step total limitation is not exceeded. Also note that the [EXE] key operation that completes each entry of data into a record also takes one step.

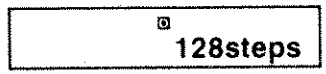


### •Checking the Number of Remaining Steps

Press [SHIFT] [CAPA] to check the number of unused steps remaining in memory.

**Example**

[SHIFT] [CAPA]




128 unused steps remain.

*The following display appears when all 279 steps are used.

[SHIFT] [CAPA]

## ■ Error Message Table

| Message | Meaning | Countermeasures |
|---|---|---|
| Syn ERROR | ① Error in calculation formula format. | ① Press [←] or [→] to locate error, and correct. |
| Ma ERROR | ① Calculation result exceeds allowable range.<br>② Input range of function exceeded (see page 67).<br>③ Mathematical error (i.e. division by zero). | ① ② ③<br>Confirm that entered values are within range. Be sure to also check values stored in memory. |
| Stk ERROR | •Overflow of numeric stack or command stack. | •Simplify calculation so that limitations of stacks are not exceeded (8 levels for numeric stack; 16 levels for command stack).<br>•Break calculation down into smaller parts and execute individually. |
| Mem ERROR | •More than 8 different variables in a single formula.<br>•Attempt to exceed 279 steps in MEMO IN mode. | •Break formula down into smaller parts so that eight or less different variables are included in each.<br>•Keep MEMO IN mode data within 279-step limit. |

## ■ Input Ranges of Functions

| Function | Input range |
|---|---|
| sin<br>cos<br>tan | (DEG) $\|x\| < 9 \times 10^{9}°$<br>(RAD) $\|x\| < 5 \times 10^{7}\pi$rad<br>(GRA) $\|x\| < 1 \times 10^{10}$grad |
| $\sin^{-1}$<br>$\cos^{-1}$ | $\|x\| \leqq 1$ |
| $\tan^{-1}$ | $\|x\| < 1 \times 10^{100}$ |
| sinh<br>cosh | $\|x\| < 230.2585092$ |
| tanh | $\|x\| < 1 \times 10^{100}$ |
| $\sinh^{-1}$ | $\|x\| < 5 \times 10^{99}$ |
| $\cosh^{-1}$ | $1 \leqq x < 5 \times 10^{99}$ |
| $\tanh^{-1}$ | $\|x\| < 1$ |
| log<br>ln | $1 \times 10^{-99} \leqq x < 1 \times 10^{100}$ |
| $10^x$ | $-1 \times 10^{100} < x < 100$ |
| $e^x$ | $-1 \times 10^{100} < x \leqq 230.2585092$ |
| $\sqrt{\ }$ | $0 \leqq x < 1 \times 10^{100}$ |
| $x^2$ | $\|x\| < 1 \times 10^{50}$ |
| $x^{-1}$ | $\|x\| < 1 \times 10^{100}$, $x \neq 0$ |
| $\sqrt[3]{\ }$ | $\|x\| < 1 \times 10^{100}$ |
| $x!$ | $0 \leqq x \leqq 69$ ($x$ is integer) |
| Pol $(x, y)$ | $x^2 + y^2 < 1 \times 10^{100}$ |
| Rec $(r, \theta)$ | $0 \leqq r < 1 \times 10^{100}$<br>(DEG) $\|\theta\| < 9 \times 10^{9}°$<br>(RAD) $\|\theta\| < 5 \times 10^{7}\pi$rad<br>(GRA) $\|\theta\| < 1 \times 10^{10}$grad |



| Function | Input range |
|---|---|
| $°\ '\ ''$ | $\|a\|$, b, $c < 1 \times 10^{100}$<br>$0 \leqq$ b, c |
| $\overleftarrow{°\ '\ ''}$ | $\|x\| < 2.777777777 \times 10^{96}$<br>Sexageimal display: $\|x\| \leqq 2777777.777$ |
| $x^y$ | $x > 0$: $-1 \times 10^{100} < y \log x < 100$<br>$x = 0$: $y > 0$<br>$x < 0$: $y = n$, $\frac{1}{2n+1}$ ($n$ is integer)<br>When: $-1 \times 10^{100} < y \log\|x\| < 100$ |
| $\sqrt[x]{y}$ | $y > 0$: $x \neq 0$<br>$-1 \times 10^{100} < \frac{1}{x} \log y < 100$<br>$y = 0$: $x > 0$<br>$y < 0$: $x = 2n + 1$, $\frac{1}{n}$ ($n \neq 0$, $n$ is integer)<br>When: $-1 \times 10^{100} < \frac{1}{x} \log\|y\| < 100$ |
| SD | $\|x\| < 1 \times 10^{50}$<br>$\|n\| < 1 \times 10^{100}$<br>$\sigma_n$, $\bar{x}$: $n \neq 0$<br>$\sigma_{n-1}$: $n \neq 0, 1$ |
| LR | $\|x\|$, $\|y\| < 1 \times 10^{50}$<br>$\|n\| < 1 \times 10^{100}$<br>$x\sigma_n$, $y\sigma_n$, $\bar{x}$, $\bar{y}$, a, b, $r$: $n \neq 0$<br>$x\sigma_{n-1}$, $y\sigma_{n-1}$: $n \neq 0, 1$ |
| $n$Pr<br>$n$Cr | Result $< 1 \times 10^{100}$ ($n$ and $r$ are integers)<br>$0 \leqq r \leqq n$, $n < 1 \times 10^{10}$ |
| BASE-N | Following conversion:<br>DEC: $-2147483648 \leqq x \leqq 2147483647$<br>BIN: $-10000000000000000000000000000000 \leqq x$<br>$\leqq 11111111111111111111111111111111$ (Negative)<br>$0 \leqq x \leqq 11111111111111111111111111111111$ (0, Positive)<br>OCT:$20000000000 \leqq x \leqq 37777777777$ (Negative)<br>$0 \leqq x \leqq 17777777777$ (0, Positive)<br>HEX: $-80000000 \leqq x \leqq$ FFFFFFFF (Negative)<br>$0 \leqq x \leqq$ 7FFFFFFF (0, Positive) |

*As a rule, the precision of results is ±1 at the 10th digit.
*Internal continuous calculations for such operations as $x^y$, $x^{1/x}$, $x!$, $\sqrt[3]{x}$ may cause cumulative errors which affect accuracy.
*For tan $x$ $|x| \neq 90° \times (2n+1)$, $|x| \neq \frac{\pi}{2}\text{rad} \times (2n+1)$, $|x| \neq 100\text{gra}(2n+1)$: when $n$ is an integer.
*The idiosyncrasies of sinh$x$ and tanh$x$ are such that accuracy is affected as their values approach $x = 0$.

# 15/Specifications

**Model:**
fx-4200P

**Calculation**

**Basic calculation functions:**
Negative numbers, exponents, parenthetical arithmetic operations (with priority sequence judgement function — true algebraic logic)

**Built-in functions:**
Trigonometric / inverse trigonometric functions (angular units: degrees, radians, grads), hyperbolic / inverse hyperbolic functions, logarithmic / exponential functions, inverse numbers, factorials, square roots, cube roots, powers, roots, squares, decimal-sexagesimal conversions, binary / octal / decimal / hexadecimal calculations, $\pi$, random numbers

**Statistical calculation functions:**
Standard deviation — number of data, sum of data, sum of squares, mean, standard deviation (two types)
Regression analysis — number of data, sum of $x$, sum of $y$, sum of squares of $x$, sum of squares of $y$, mean of $x$, mean of $y$, standard deviation of $x$ (two types), standard deviation of $y$ (two types), constant term, regression coefficient, correlation coefficient, estimated value of $x$, estimated value of $y$

**Memories:**
1 independent memory
6 constant memories
8 variable memories

**Calculation range:**
$\pm 1 \times 10^{-99} \sim \pm 9.999999999 \times 10^{99}$, and 0. Internal calculation uses 12-digit mantissa.

**Rounding:**
Performed according to the specified number of significant digits or the number of specified decimal places.

**Exponential display:**
Norm 1 — $10^{-2} > |x|, |x| \geqq 10^{10}$
Norm 2 — $10^{-9} > |x|, |x| \geqq 10^{10}$



**MEMO function**

Number of steps — 279 maximum
Data search — Sequential Search and Initial Search

**Check function:** Data editing, insert, delete

**General**

**Display:**
12-digit dot matrix display, 10-digit mantissa plus 2-digit exponent

**Power supply:** One lithium battery (CR2032)

**Power consumption:** 0.002W

**Battery life:** Approximately 5,500 hours for CR2032 (continuous use)

**Auto power OFF:**
Approximately six minutes after last key operation

**Ambient temperature range:**
0°C – 40°C (32°F – 104°F)

**Dimensions:** 9H × 73W × 129mmD ($^3/_8$"H × 2 $^7/_8$"W × 5"D)

**Weight:** 71 g (2.5 oz)